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The Journal *of the* Society of Dyers and Colourists

Volume 75 Number 1

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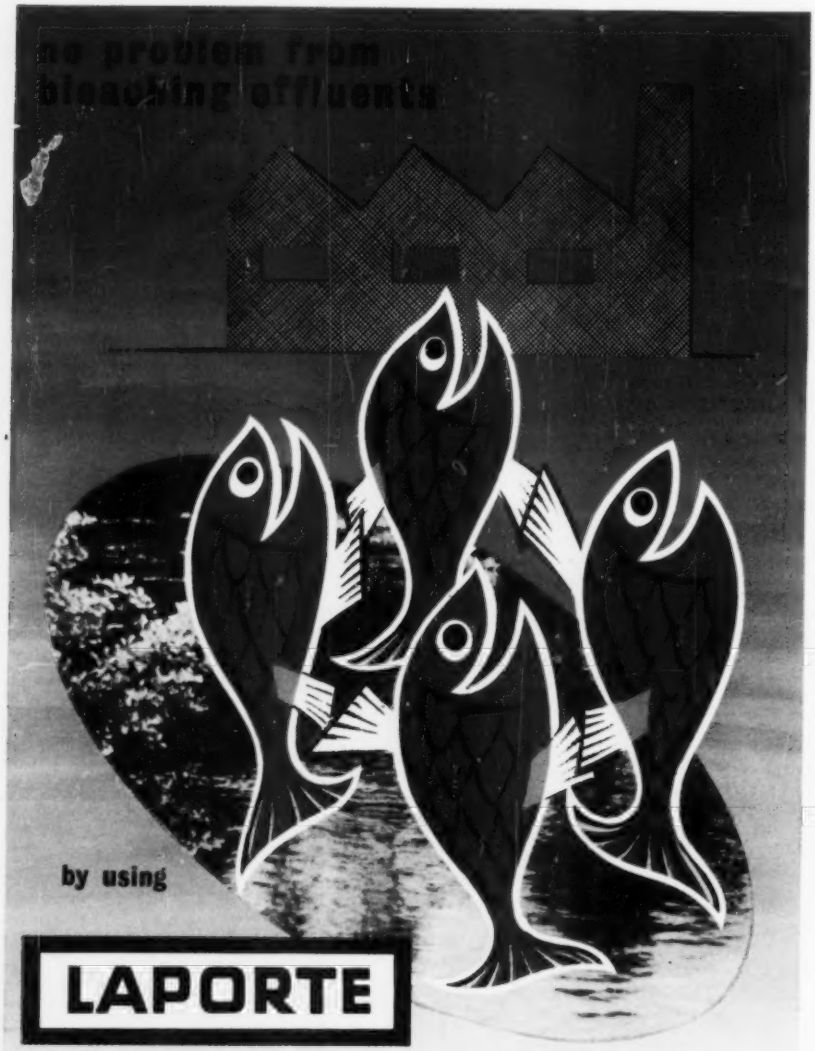

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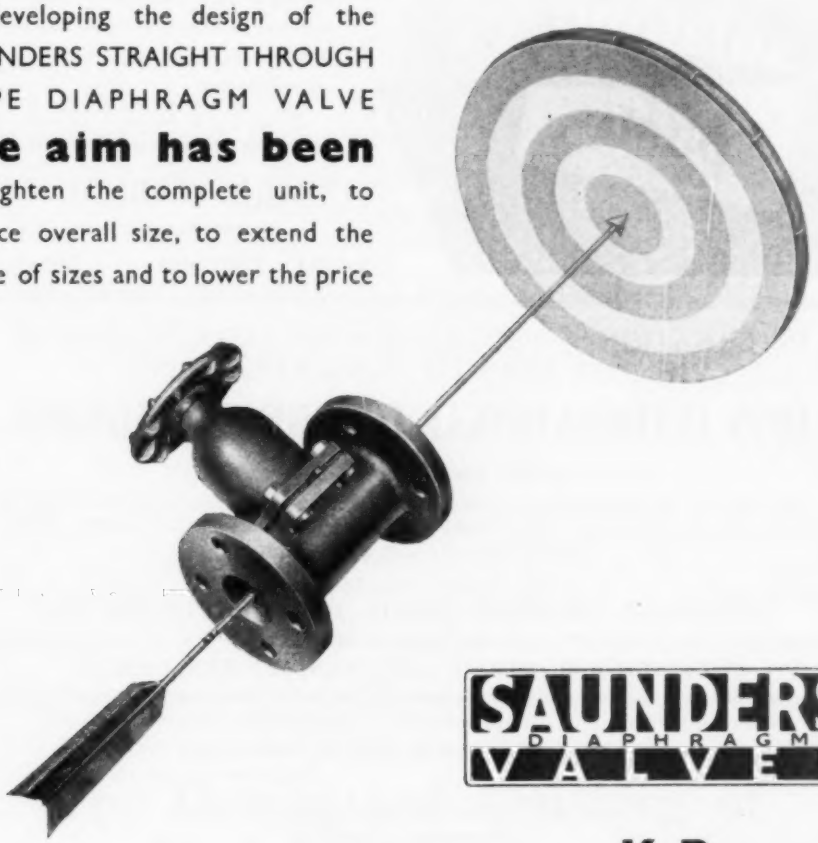

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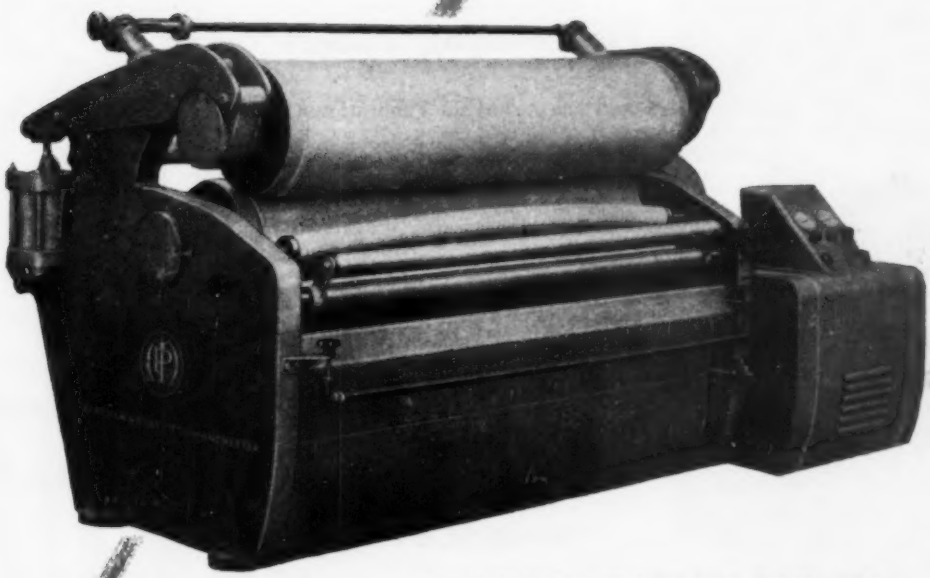

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NOTICE TO MEMBERS AND SUBSCRIBERS

Readers requiring *general information* regarding the Official Notices, List of Officers of the Society, etc, should consult pages 1–10 of the January 1959 and pages 509–516 of the July 1958 issues of the *Journal*, or write to *The General Secretary*, The Society of Dyers and Colourists, Dean House, 19 Piccadilly, Bradford 1, Yorkshire (*Telephone* Bradford 25138). *Editorial Communications* should be addressed to *The Editor*, at the same address.

Forthcoming Papers

The following papers have been accepted by the Publications Committee, and will appear in future issues of the *Journal*—

LECTURES

Some Chemical Foundations of Fast Colour Printing — *F. R. Alsberg, W. Clarke, and A. S. Fern*

The Life and Times of Peter Griess — *W. H. Cliffe*

The Mechanism of the Dyeing of Polyester Fibres with Disperse Dyes — *O. Glenz*

Acrylonitrile in the Textile Industry — *J. H. MacGregor*

The Mechanisms of Diazotisation — *J. H. Ridd*

Some Experiments on the Effect of Dye, Fibre, and Atmosphere on Light Fastness — *G. Schwen and G. Schmidt*

COMMUNICATION

Flash Photolysis of Vat Dyes — *N. K. Bridge and W. M. Maclean*

EXPLANATORY PAPER ON MODERN THEORY

Surface Activity, Solution, and Adsorption — *C. H. Giles*

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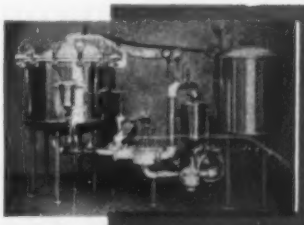

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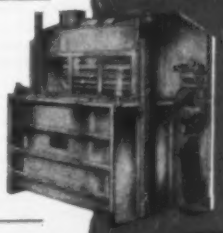

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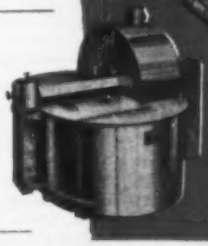

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FORTHCOMING MEETINGS OF THE SOCIETY

Friday, 23rd January 1959

LONDON SECTION. Annual Dinner and Dance. Waldorf Hotel, **London, W.C.2.** 7 p.m. for 7.30 p.m.

WEST RIDING SECTION. Ladies Evening. Victoria Hotel, Bridge Street, **Bradford.**

Monday, 26th January 1959

BRADFORD JUNIOR BRANCH. *Recent Developments in the use of Terylene Staple Fibre in the Woollen and Worsted Industry.* P. W. Eggleston, Esq. (Imperial Chemical Industries Ltd.). Institute of Technology, **Bradford** 7.15 p.m.

Saturday, 31st January 1959

MANCHESTER SECTION. Annual Dinner and Dance, Grand Hotel, **Manchester.** 6 p.m. for 6.30 p.m.

Tuesday, 3rd February 1959

LEEDS JUNIOR BRANCH. *Colour Matching.* E. Bellhouse, Esq., B.Sc. Lecture Theatre, Department of Colour Chemistry and Dyeing, The University, **Leeds.** 3.15 p.m.

Thursday, 5th February 1959

MIDLANDS SECTION. *Developments in Modern Dry-cleaning Techniques.* E. J. Davies, Esq., M.Sc. Gas Board Theatre, **Nottingham.** 7 p.m.

Friday, 6th February 1959

LONDON SECTION. *Colour Photography.* Dr. R. W. G. Hunt (Kodak Ltd.). The Royal Society, Burlington House, **London W.1.** 6 p.m.

Tuesday, 10th February 1959

BRADFORD JUNIOR BRANCH. *New Levelling Agents in Acid and Direct Dyebaths.* G. H. Lister, Esq., B.Sc., Ph.D. (Sandoz Products Ltd.). Institute of Technology, **Bradford.** 7.15 p.m.

NORTHERN IRELAND SECTION. *Some Observations in the Uses of Synthetic Resin Products and Chemical Reactants to Cellulosic Materials.* F. R. W. Sloan, Esq., M.Sc. Ph.D. (Kirkpatrick Bros. Ltd.). Grosvenor Rooms, **Belfast.** 7.30 p.m.

SCOTTISH SECTION. *The Use of Antistatic Agents in Textile Processing.* A. E. Henshall, Esq., B.Sc. (Imperial Chemical Industries Ltd.). (Joint meeting with the Textile Institute.) St. Enoch Hotel, **Glasgow.** 7.15 p.m.

Thursday, 12th February 1959

WEST RIDING SECTION. *New Ideas in the Application of Phthalocyanine Derivatives to Textiles.* Dr. F. Gund. (Farbenfabriken Bayer). Griffin Hotel, Boar Lane, **Leeds.** 7.30 p.m.

Tuesday, 17th February 1959

HUDDERSFIELD SECTION. *The Use of Antistatic Agents in Textile Processing—Advantages and Disadvantages.* A. E. Henshall, Esq., B.Sc. (Imperial Chemical Industries Ltd.) Silvios Cafe, **Huddersfield.** 7.30 p.m.

Thursday, 19th February 1959

MANCHESTER JUNIOR BRANCH. *Chlorite Bleaching.* W. J. Watts, Esq., B.Sc. Room J/B 16 — Chemical Engineering Building (Jackson Street), College of Science and Technology, **Manchester.** 4.30 p.m.

SCOTTISH JUNIOR BRANCH. *Colour Vision.* Dr. Mary Collins (Department of Psychology, Edinburgh University), also *How the World Looks to a Colour Defective* (a short colour film obtained through the courtesy of the Department of Naval Research, United States of America). Technical College, **Paisley.** 7.30 p.m.

Friday, 20th February 1959

MANCHESTER SECTION. *Emulsion Thickenings. Possibilities in Textile Printing.* T. L. Dawson, Esq., B.Sc., Ph.D., A.R.I.C., F.C.S. (Imperial Chemical Industries Ltd.). The Textile Institute, 10 Blackfriars Street, **Manchester.** 7 p.m.

Wednesday, 25th February 1959

BRADFORD JUNIOR BRANCH. *Vat Dyeing of Cotton Piece Goods by Pre-pigmentation Routes.* M. R. Fox, Esq., F.T.I., F.S.D.C. and J. F. Mawson, Esq., B.Sc. (Imperial Chemical Industries Ltd.). Institute of Technology, **Bradford.** 7.15 p.m.

Thursday, 26th February 1959

WEST RIDING SECTION. *Fast Shades on Wool–Cellulose Unions.* D. R. Lemin, Esq., B.Sc. (Imperial Chemical Industries Ltd.). Victoria Hotel, Bridge Street, **Bradford.** 7.30 p.m.

Friday, 6th March 1959

LONDON SECTION. *The Use of Antistatic Agents in Textile Processing.* A. E. Henshall, Esq., B.Sc. (Imperial Chemical Industries Ltd.). The Royal Society, Burlington House, **London W.1.** 6 p.m.

MIDLANDS SECTION. Section Annual Dinner. George Hotel, **Nottingham.**

Tuesday, 10th March 1959

LEEDS JUNIOR BRANCH. *New Methods for the Assessment of Dyeing Properties and Usability of Dyes.* G. H. Lister, Esq., B.Sc., Ph.D. Lecture Theatre, Department of Colour Chemistry and Dyeing, The University, **Leeds.** 3.15 p.m.

NORTHERN IRELAND SECTION. *Stenter Drying.* T. A. Uthwatt, Esq., B.A., A.M.I.E.E., and J. S. Woollatt, Esq., B.Sc. (Mather & Platt Ltd.). Grosvenor Rooms, **Belfast.** 7.30 p.m.

SCOTTISH SECTION. Annual General Meeting. 7 p.m. Followed by *Modern Cloth Drying Principles and Machines.* K. S. Laurie, Esq., A.M.I.Mech.E., A.M.I.E.E. (John Dalglish & Sons Ltd.). St. Enoch Hotel, **Glasgow.** 7·15 p.m.

Wednesday, 11th March 1959

SCOTTISH JUNIOR BRANCH. Annual General Meeting 7 p.m. *Dyeing Unions Containing Acrylic Fibres.* B. Kramrisch, Esq., F.R.I.C., F.T.I., F.S.D.C. (Ciba Clayton Ltd.). Technical College, **Paisley.** 7.30 p.m.

Thursday, 12th March 1959

BRADFORD JUNIOR BRANCH. *Sizing Materials— Their Chemistry and Application.* J. H. MacGregor, Esq., Ph.D., F.R.I.C., F.C.S. (Courtaulds Ltd.). Institute of Technology, **Bradford.** 7.15 p.m.

MIDLANDS SECTION. *Dyeing and the Future.* J. Boulton, Esq., M.Sc.Tech., F.R.I.C., F.T.I., F.S.D.C., President of the Society. (Joint meeting with the Coventry Textile Society.) Courtauld's Acetate and Synthetic Fibres Laboratory, Lockhurst Lane, **Coventry.** 7 p.m.

SCOTTISH SECTION. *The Reactivity of Keratin.* Professor J. B. Speakman, D.Sc., F.R.I.C., F.T.I., F.S.D.C. Scottish Woollen Technical College, **Galashiels.** 7.30 p.m.

WEST RIDING SECTION. *The Sorption of Moisture by Fibre-forming Polymers.* L. Valentine, Esq., B.Sc., Ph.D. (Tootal Broadhurst Lee Co. Ltd.). Victoria Hotel, Bridge Street, **Bradford.** 7.30 p.m.

Saturday, 14th March 1959

BRADFORD JUNIOR BRANCH. Annual General Meeting. Institute of Technology, **Bradford.** 10.15 a.m.

Tuesday, 17th March 1959

HUDDERSFIELD SECTION. *Fast Shades on Wool–Cellulose Unions. Recent Advances in this Field.* D. R. Lemin, Esq., B.Sc. (Imperial Chemical Industries Ltd.). Silvios Cafe, **Huddersfield.** 7.30 p.m.

Wednesday, 18th March 1959

MIDLANDS SECTION. *Photoelectric Colorimeters . . . their uses and limitations in the Dyehouse.* J. V. Alderson, Esq., B.Sc., A.R.C.S. (Joint meeting with the British Association of Chemists.) Midland Hotel, **Derby.** 7 p.m.

Thursday, 19th March 1959

MANCHESTER JUNIOR BRANCH. Films— *Silk. Principles of Chromatography. How the World Looks to a Colour Defective.* Room J/B 16 — Chemical Engineering Building (Jackson Street), College of Science and Technology, **Manchester.** 4.30 p.m.

Friday, 20th March 1959

MANCHESTER SECTION. *Symposium on Re-active Dyes.* College of Science and Technology, **Manchester.** Further details later.

continued on page xxxvi

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THE JOURNAL

OF THE

Society of Dyers and Colourists

Volume 75 Number 1 JANUARY 1959 *Issue I Monthly*

THE SOCIETY OF DYERS AND COLOURISTS

The Society of Dyers and Colourists was founded in Bradford in 1884, with the object of "promoting Scientific and Technical Knowledge among Textile Colourists, and the general advancement of the interests of the tinctorial and allied industries excluding all questions connected with wages and trade regulations."

The Society now has seven Sections—Huddersfield, London, Manchester, Midlands, Northern Ireland, Scottish, and West Riding—with four Junior Branches—Bradford, Leeds, Manchester, and Scottish. It has two affiliated societies—The Society of Dyers and Colourists of Australia and the Dyers and Colourists Association of South Africa.

Objects

To promote the advancement of science and technology, especially in the theory and practice of the tinctorial arts.

To provide means for the wider dissemination and interchange of knowledge concerning the science and technology of colour and colouring matters, of their methods of application, and of the materials to which they may be applied.

To encourage education and research in any or all of the above subjects.

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And to do all such other things as may be conducive to the attainment of these objects.

Election of Officers and Members of Council

Officers and Members of Council—other than the President and President-elect, who are nominated by Council and elected at the Annual General Meeting—are elected by a Postal Ballot of the members.

The attention of members is drawn to Bye-laws No. 12–21 inclusive and 22–26 inclusive, which relate to Officers and Members of Council respectively.

Nominations must be received by the Honorary Secretary of the Society six weeks prior to the date of the Annual General Meeting.

Members and Junior Members

Persons desirous of joining the Society as Ordinary Members or Junior Members may obtain Application Forms from the General Secretary or from the Honorary Secretary of any Section of the Society. Applications must be proposed and seconded by members to whom the applicants are known personally. The rates of annual subscription are as follows—

(i) Ordinary Members—£3 3s. 0d.

(ii) Junior Members (under 21 years of age)—15s. 0d.

(iii) Ordinary Members between the ages of 21 and 25 years who are students, i.e. who are pursuing an accepted course, full or part time, at a recognised technical college or university and vouched for by the head of their department or other responsible person—15s. 0d.

(iv) Other Ordinary Members between the ages of 21 and 25 years—£2 2s. 0d.

(v) Members having had continuous membership of the Society for forty years to be given the option of paying half the current annual subscription for Ordinary Members.

(vi) Members having had continuous membership of the Society for fifty years—the annual subscription to be waived entirely.

(vii) During the period of national service the annual subscription may be waived. Such members will be given the opportunity of continuing to receive the *Journal* without charge.

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THE SOCIETY OF DYERS AND COLOURISTS

The Society of Dyers and Colourists was founded in Bradford in 1884, with the object of "promoting Scientific and Technical Knowledge among Textile Colourists, and the general advancement of the interests of the tinctorial and allied industries excluding all questions connected with wages and trade regulations."

The Society now has seven Sections— Huddersfield, London, Manchester, Midlands, Northern Ireland, Scottish, and West Riding— with four Junior Branches— Bradford, Leeds, Manchester, and Scottish. It has two affiliated societies— The Society of Dyers and Colourists of Australia and the Dyers and Colourists Association of South Africa.

Objects

To promote the advancement of science and technology, especially in the theory and practice of the tinctorial arts.

To provide means for the wider dissemination and interchange of knowledge concerning the science and technology of colour and colouring matters, of their methods of application, and of the materials to which they may be applied.

To encourage education and research in any or all of the above subjects.

And for the furtherance of these objects—

To hold meetings for the reading of papers, for lectures, and for discussions.

To publish a *Journal*.

And to do all such other things as may be conducive to the attainment of these objects.

Election of Officers and Members of Council

Officers and Members of Council— other than the President and President-elect, who are nominated by Council and elected at the Annual General Meeting— are elected by a Postal Ballot of the members.

The attention of members is drawn to Bye-laws No. 12–21 inclusive and 22–26 inclusive, which relate to Officers and Members of Council respectively.

Nominations must be received by the Honorary Secretary of the Society six weeks prior to the date of the Annual General Meeting.

Members and Junior Members

Persons desirous of joining the Society as Ordinary Members or Junior Members may obtain Application Forms from the General Secretary or from the Honorary Secretary of any Section of the Society. Applications must be proposed and seconded by members to whom the applicants are known personally. The rates of annual subscription are as follows—

(i) Ordinary Members— £3 3s. 0d.

(ii) Junior Members (under 21 years of age)— 15s. 0d.

(iii) Ordinary Members between the ages of 21 and 25 years who are students, i.e. who are pursuing an accepted course, full or part time, at a recognised technical college or university and vouched for by the head of their department or other responsible person— 15s. 0d.

(iv) Other Ordinary Members between the ages of 21 and 25 years— £2 2s. 0d.

(v) Members having had continuous membership of the Society for forty years to be given the option of paying half the current annual subscription for Ordinary Members.

(vi) Members having had continuous membership of the Society for fifty years— the annual subscription to be waived entirely.

(vii) During the period of national service the annual subscription may be waived. Such members will be given the opportunity of continuing to receive the *Journal* without charge.

Members residing abroad are particularly requested to inform the General Secretary by separate post when forwarding their subscriptions.

Diplomas in Tinctorial Technology

The Society confers diplomas in tinctorial technology on suitably qualified members. These distinctions are in two grades — the Associateship (A.S.D.C.) and the Fellowship (F.S.D.C.). To obtain the Associateship candidates are required to pass the prescribed examinations and to furnish evidence of satisfactory general education and of training and experience in at least one branch of the manufacture or application of colouring matters. The Associateship has been accepted as a degree equivalent for the purposes of the Burnham Main and Technical Reports. The Fellowship is conferred on senior members who have attained high standing in the knowledge and practice of tinctorial technology. Students who intend to take the Society's examination are strongly recommended to become Registered Students, so that their studies and preparation may be directed effectively.

Copies of the regulations and syllabuses may be obtained on application to the offices of the Society.

The Journal

All members of the Society receive a copy of the *Journal* monthly.

Subscribers may receive the *Journal* for twelve months on payment of £5 5s. 0d.

Back numbers are supplied at 8s. 9d. per copy.

Communications on any subject related to the objects of the Society, especially such as are of an original character, are invited for consideration for publication in the *Journal*. Such Communications in the first instance should be addressed to the Editor at the offices of the Society.

General communications, including enquiries or orders for advertisements, should be addressed to the General Secretary.

Reprints of Lectures and Communications

Reprints of all lectures and communications are available if ordered immediately after publication. The charges (postage included) are as follows— Single copies 3s. 4d. each; per dozen copies up to and including 8 pages 16s. 0d., and for papers occupying more than 8 pages of the *Journal* 22s. 6d.

Abstracts Section

One-sided copies of the Abstracts, suitable for pasting on cards, are available at a charge of £2 0s. 0d. per annum.

Free Advertisements

For the convenience of members a limited number of advertisements relating to SITUATIONS WANTED may be inserted in the *Journal* gratis. Such advertisements must not exceed 24 words in length.

Replies may be addressed *Box—, Society of Dyers and Colourists, Dean House, 19 Piccadilly, Bradford 1, Yorkshire.*

Notice to Authors of Papers

The MSS. of all papers communicated to or read before the Society become the property of the Society. They should be addressed to the Editor at the offices of the Society. Authors must not allow their papers to be published elsewhere before they have appeared in the Society's *Journal*. Should prior publication take place without the sanction of the Publications Committee, the paper will be printed only as an abstract or summary.

Manuscripts submitted for publication in the *Journal* should be typewritten (double spacing) on good quality paper, using one side of the paper only and leaving a margin at least 1 in. wide on the left-hand side. The time taken in refereeing papers (both lectures and communications) will be reduced to a minimum when authors submit two copies of the typescript.

In view of the high costs of publication, it is essential that authors should be as concise as possible. When experimental procedure has already been published, a literature reference to the paper containing the details is sufficient, and well known experimental methods should be described only very briefly.

Introductory paragraphs describing the aims of the investigation and the method of attack are desirable, and should be followed by the experimental results and their discussion. There should be a brief summary for insertion at the beginning of the paper. Centre headings should be employed sparingly. Side headings should be indented and underlined, and run into the text to which they apply by means of a dash. References to the literature should be numbered consecutively, using superscript numbers without brackets immediately following the text words or author's name to which they refer.

The list of references should be given at the end of the manuscript, and the abbreviations used should be, as far as possible, those given in the "List of Periodicals Abstracted" included at the end of the Index to the preceding year's *Journal*. Reference numbers in this list should be neither enclosed in brackets nor followed by full-stops. As far as possible throughout the manuscript the abbreviations listed in the Annual Index should be used. Tables should be numbered consecutively in Roman numerals and Figures in Arabic numerals.

The number of figures and graphs should be kept as low as possible, and results should be presented in the form of either tables or graphs, not both. Drawings should be carefully prepared, preferably in Indian ink, on plain white drawing paper, tracing paper or cloth, or, preferably, Bristol board (but duplicate drawings for refereeing purposes need be only roughly prepared). Graphs should be enclosed in a complete frame; co-ordinate lines should be omitted, except for very short lengths along the axes. Experimental points should be indicated by symbols selected from the following fourteen, which are readily available to the printer—

In a series of Figures containing graphs of similar type, consistent use of symbols will be a help to the reader. In preparing drawings the author must see that thickness of and separation between lines and size of experimental points are adequate for reduction of the drawings, usually to column width (about 2¼ in.). Any numbering or lettering on the drawings should be indicated lightly in pencil, *not* drawn in ink.

Twenty-five free copies of a reprint are supplied to the author of an original paper published in the *Journal*, or fifty free copies are supplied when there are two or more authors, and a further number may be purchased from the Society at the rates given above.

Copyright

Original articles, papers, and communications printed in this *Journal* are copyright. Subject to full acknowledgment being made, up to, but not exceeding, 800 words may be published elsewhere, but application for permission to reprint *in extenso* should be addressed to the Editor of the *Journal* at the offices of the Society.

The Society subscribes to the Royal Society Fair Copying Declaration (J.S.D.C., **66**, 54 (Jan. 1950); **67**, 236 (June 1951)).

The Society's Library

Many of the books and periodicals reviewed or abstracted in the *Journal* since 1948 (and in some cases earlier) are retained by the Society, and may be borrowed by members. Enquiries and applications should be directed to the Editor at the offices of the Society.

Historical Records

The Society is glad to receive gifts of old books, pattern cards, and other documents for inclusion if suitable in its collection of historical records related to the tinctorial arts.

Library of the Chemical Society— Loan of Books

Members of the Society may borrow books from the very extensive collection of works on pure and applied chemistry in the Library of the Chemical Society, by applying direct to *The Librarian, The Chemical Society, Burlington House, Piccadilly, London W. 1 (REGent 0675–6), and referring to their membership of the Society of Dyers and Colourists.*

Deposit of Sealed Communications

The Society is prepared to receive from members and others and to keep as deposits Sealed Communications dealing with any subject relating to the theory or practice of the dyeing, printing, and kindred industries.

Further particulars will be supplied on application.

MEDALS AND AWARDS

Honorary Members of the Society

1886	*Sir H. E. Roscoe, M.P.
1902	*Dr. F. H. Bowman
1908	*Prof. C. Graebe
1908	*Prof. C. Liebermann
1911	*Prof. Adolf von Baeyer
1914	*Count Hilaire de Chardonnet
1917	*Prof. Arthur G. Green
1919	*R. Vidal
1920	The Prime Warden of the Worshipful Company of Dyers (*ex officio*)
1921	*Horace A. Lowe
1923	*Charles F. Cross
1925	*Maurice Prud'homme
1927	*Ernest Hickson
1928	*Dr. R. E. Schmidt
1931	*Dr. Alfred Rée
1932	*Prof. W. M. Gardner
1934	*George Douglas
1934	*H. Grandage
1934	*Christopher Rawson
1941	*Prof. E. C. C. Baly, C.B.E.
1944	*Prof. F. M. Rowe
1946	*James S. Ridsdale
1947	Dr. C. J. T. Cronshaw
1948	*H. Jennison, M.C.
1950	*George E. Holden, C.B.E.
1953	John Barritt, O.B.E.
1954	Fred Scholefield
1954	Dr. C. M. Whittaker
1955	Sir Robert Robinson, O.M., Nobel Laureate
1956	Fred Smith

The following have been *ex officio* Honorary Members of the Society, the later dates indicating termination or change in the title of the office—

1886–1920	The Worshipful Master of the Dyers' Company
1886–1900	The President, Bradford Technical College
1900–1905	*W. E. B. Priestley, Chairman of the Technical Instruction Committee of the Bradford City Council

* Deceased

The Perkin Medal

The Perkin Medal is an excellent representation of the head of Sir William Perkin, the founder of the coal-tar colour industry, and President of the Society in 1907.

This medal is awarded for discoveries or work of outstanding importance in connection with the tinctorial arts.

List of Recipients

1908	Professors Graebe and Liebermann	Synthesis of Alizarin
1911	Prof. Adolf von Baeyer	Synthesis of Indigo
1914	Comte Hilaire de Chardonnet	Artificial Silk
1917	Prof. A. G. Green	Primuline
1919	R. Vidal	Sulphur Black
1921	Horace Lowe	Permanent Lustre on Cotton
1923	C. F. Cross	Discovery of Viscose
1925	M. Prud'homme	Aniline Black and Alizarin Blue
1928	Dr. R. E. Schmidt	For Epoch-making Discoveries of Anthraquinone Derivatives and Dyestuffs therefrom
1938	Dr. H. Dreyfus	For Discoveries and Work of Outstanding Importance in Connection with the Development of the Cellulose Acetate Rayon Industry in England
1938	J. Baddiley	In recognition of his National Services for the Renaissance of the British Dyestuffs Industry through Many Important Investigations in the Field of Colour Chemistry Conducted or Directed by him
1950	Prof. J. B. Speakman	In recognition of his Outstanding Contributions to the Science and Technology of Textiles
1954	Dr. A. Zitscher	For his Work leading to the Discovery of the New Class of Azoic Dyes, based on the Arylamides of *o*-Hydroxycarboxylic Acids
1956	Dr. W. H. Carothers (posthumous award)	For the Discovery of Nylon
	John R. Whinfield, C.B.E.	For the Discovery of Terylene

The Medal of the Society of Dyers and Colourists

This Medal was instituted by the Society in 1908. The design indicates that the work of the dyer (centre figure) is both a science (right background) and an art (left foreground).

1908–1927 The Medal was occasionally awarded as a recognition of work of exceptional merit carried out under the Society's Research Scheme.

From 1928 The Medal was awarded as a recognition of exceptional services (*a*) to the Society or (*b*) in the interests of the Tinctorial and Allied Industries.

List of Recipients

Gold Medal

1928	Ernest Hickson	Exceptional Services rendered to the Society as Chairman of the Publications Committee 1897–1925, and Chairman of *Colour Index* Committee
1930	Arthur Silverwood	Exceptional Services rendered to the Society as Honorary Secretary 1913–1930
1933	Prof. Walter M. Gardner	Distinguished Services as Editor of the Society's *Journal* 1900 to 1932
1934	Prof. F. M. Rowe	Exceptional Services to the Society and to the Tinctorial Industries as Editor of the *Colour Index* 1924 and the Supplement 1928
1940	F. L. Goodall	Valuable Services to the Tinctorial Industries by his work on the Theory and Practice of Wool Dyeing
1943	C. M. Whittaker	In recognition of Exceptional Services in promoting Scientific and Technical Knowledge amongst Textile Colourists, and for Sustained and Outstanding Service to the Society
1946	H. H. Bowen	For Outstanding Services to the Society and in recognition of his Chairmanship of the Publications Committee for a period of twenty years
	H. H. Hodgson	For Outstanding Services to the Society and for his series of Sustained Experimental and Theoretical Contributions to those chapters of Organic Chemistry which are the essential scientific background to the Dyestuffs Industry
1947	Fred Smith	For Exceptional Services to the Society over a period of thirty-seven years comprising Chairman, West Riding Section; Member of Council and of many important Committees
	F. Scholefield	In recognition of Exceptional Services to the Society in the advancement of Tinctorial Technology both in theory and practice
1948	G. G. Hopkinson	For Valuable Services rendered to the Society and to the Dyeing Industry
1949	S. M. Neale	For his Pioneer Work in the Application of the Methods of Physical Chemistry to the Elucidation of the Phenomena of Dyeing, more particularly of Cellulosic Materials with Substantive Dyes
1950	P. W. Cunliffe	For Outstanding Services to the Society and to the Tinctorial and Allied Industries
	H. Foster	For Outstanding Services to the Society
1951	W. Kilby	For Work on the Development of a Molten Metal Process of Continuous Dyeing
1953	H. A. Turner	For his Valuable Researches contributed to the Tinctorial Industries
1954	G. S. J. White	For Exceptional Services to the Society and to the Tinctorial and Allied Industries
1955	P. W. Cunliffe (Bar)	For Continued Valuable Services to the Society as Chairman of the Fastness Tests Co-ordinating Committee
1956	C. O. Clark	For Outstanding Services to the Society

***Gold Medal*—continued**

1957	J. BARRITT, O.B.E.	For Exceptional Services to the Society as Chairman of the *Colour Index* Editorial Panel
1958	H. BLACKSHAW	For Exceptional Services to the Society
	H. H. BOWEN (Bar)	For Exceptional Services to the Society
	Prof. W. BRADLEY	For Exceptional Services to the Society
	C. O. CLARK (Bar)	For Exceptional Services to the Society
	J. G. GRUNDY	For Exceptional Services to the Society
	R. J. HANNAY	For Exceptional Services to the Society
	H. H. HODGSON (Bar)	For Exceptional Services to the Society
	M. LAPWORTH	For Exceptional Services to the Society
	A. THOMSON	For Exceptional Services to the Society
	T. VICKERSTAFF	For Exceptional Services to the Society and for Research in the Tinctorial Arts

Silver Medal

1912	J. H. GARNER	Treatment of Effluents from Dyehouses and Textile Factories
1934	L. A. LANTZ (*Chairman*) H. H. BOWEN P. W. CUNLIFFE R. S. HORSFALL Prof. B. A. MCSWINEY C. C. N. VASS C. M. WHITTAKER S. G. BARKER	Exceptional Services to the Society as Members of the Standardisation of Fastness Executive Committee
1936	W. A. EDWARDS	Valuable Services rendered to the Society as Honorary Secretary of the Midlands Section since its inception in 1919 to 1935
1937	R. RITCHIE	Devoted and Valuable Services as Honorary Secretary of the Scottish Section for eighteen years
1946	E. RACE	For his Valued Services to the Society as Joint Author of thirteen papers published in the Society's *Journal*
	H. TURNER	In recognition of his Valuable Services to the Society and of his twenty-two years' service as Honorary Secretary of the Huddersfield Section
	Mrs. E. CUMMINGS (*née* Levin)	For her Valued Services to the Society; by her assistance rendered in the preparation of the first *Colour Index*; by her Joint Authorship of a number of Papers published in the *Journal* of the Society, and as an Abstractor for the *Journal* of the Society for twenty years
1947	C. SCHARDT	In recognition of his Valuable Services to the Society over a period of twenty-four years including Chairman, Vice-Chairman, and member, of the Midlands Section Committee
1948	D. B. F. MCANDREW	For Valuable Services rendered to the Society as Honorary Secretary and Committee Member of the Scottish Section 1935–1947
	C. O. CLARK	For Valuable Services rendered to the Society from 1923 to 1948
1950	L. A. LANTZ (Bar)	For Exceptional Services to the Society and to the Tinctorial and Allied Industries in connection with Fastness Tests
1953	A. W. CARPENTER	For Valuable Services to the Society
1954	C. C. WILCOCK	For Exceptional Services to the Society and to the Tinctorial and Allied Industries
1955	H. W. ELLIS	For Valuable Services to the Society as Honorary Secretary of the London Section 1938–1954
	J. G. GRUNDY	For Valuable Services to the Society as Chairman of the Washing Fastness Subcommittee
	K. MCLAREN	For Valuable Services to the Society as Honorary Secretary of the Fastness Tests Co-ordinating Committee
	J. PORTER	For Outstanding Services to the Society, notably in the Inauguration and the Development of the Northern Ireland Section
	M. E. PROBERT	For Valuable Services to the Society as Chairman of the Bleaching Fastness Subcommittee

***Silver Medal*— continued**

1955	J. V. SUMMERSGILL	For Valuable Services to the Society as Honorary Secretary of the Publications Committee from 1945 to date
	E. WILSON	For Valuable Services to the Society as Chairman of the Alkaline Milling, Burnt-gas Fumes, and Perspiration Fastness Subcommittees
1957	F. ATACK	For Services to the Society as Honorary Secretary of the Scottish Section 1947–1957
1958	A. W. CARPENTER (Bar)	For Continued Valuable Services to the Society
	R. L. ELLIOTT	For Valuable Services to the Society
	H. TURNER (Bar)	For Continued Valuable Services to the Society

Bronze Medal

1908	J. B. FOTHERGILL	Treatment of Cotton to Cause it to Resist Direct Dyeing Colours
1953	Miss M. FORBES	For Valuable Services to the Society
	H. R. HADFIELD	For Valuable Services to the Society
1958	K. MELDRUM	For Valuable Services to the Society
	J. K. SKELLY	For Valuable Services to the Society
	H. W. TAYLOR	For Valuable Services to the Society
	Mrs. J. M. FIRTH	For Valuable Services to the Society

The Worshipful Company of Dyers Research Medal

The Medal represents the Arms of the Worshipful Company of Dyers of the City of London, which were granted in 1471. The following is a brief description—

Arms— Sable, a chevron engrailed argent, between three bags of madder of the last, corded or.

Crest— On a wreath three sprigs of the graintree erect vert, fructed gules.

Supporters— Two leopards rampant gardant argent, spotted with various colours; fire issuing from their ears and mouth proper, both ducally crowned or.

Motto— Da Gloriam Deo.

1— The Dyers' Company offer annually a Gold Medal called "The Worshipful Company of Dyers Research Medal", the award of which is open to the authors of papers embodying the results of scientific research or technical investigation connected with the tinctorial arts submitted to the Society of Dyers and Colourists, and published in the *Journal* of such Society during the twelve months ending on the 30th June in the year for which the Medal is granted, and, in the special circumstance provided for by Rule 6, during the twelve months ending on the 30th June in the year previous to that for which the Medal is granted. If a paper shall be published in two or more parts, then for the purpose of the award of the Medal, all the parts together shall be treated as a paper published in the year in which the final part is published.

2— The Medal will not be awarded to the same person on more than one occasion.

3— The Society of Dyers and Colourists shall consider the papers available for the Medal and advise the Company as to the merits thereof, and if, in the judgment of the Society, none of the papers is of sufficient merit, the Society may recommend that the Medal be not awarded.

4— The Dyers' Company will award the Medal either to the author of the paper which, in all the circumstances, appears to the Company to show the greatest merit, or, in the event of such paper being the work of an author who has already been awarded the Medal, to the author of the paper next in order of merit who has not already been awarded the Medal, and may, if the Company so thinks fit, refrain from making any award.

5— In the event of a paper being the work of two or more persons, the author shall be taken to be that one of them whose work in the opinion of the Society of Dyers and Colourists has most substantially contributed to the merit of the scientific research or technical investigation embodied in such paper.

6—In the event of the author of a paper of sufficient merit published in the *Journal* of the Society of Dyers and Colourists during any twelve months for which the Medal is awarded being unsuccessful in obtaining the award of the Medal for that period, the Society of Dyers and Colourists may, in their discretion, consider such paper for adjudication with the papers available for the award of the Medal for the next succeeding twelve months.

List of Recipients

1908	Prof. E. KNECHT	A Means of Estimating the Degree of Mercerisation in Cotton Yarns
1909	Prof. ARTHUR G. GREEN	The Chemical Technology of Aniline Black
1910–11	R. L. TAYLOR	The Action of Carbon Dioxide and of Air on Bleaching Powder

1911–12	W. Harrison	The Electrical Theory of Dyeing
1912–13	S. H. Higgins	Observations on the Bleaching of Cotton *and* The Action of Neutral Salts on Bleaching Solutions
1913–14	W. Johnson (in conjunction with Prof. Arthur G. Green)	The Constitution of Aged and of Bichromate Aniline Blacks
1914–15	Morris Fort	The Mechanism of the Acid Dyebath
1915–16	James R. Hannay	The Interaction between Metallic Copper and certain Dyes of the Thiazine, Oxazine and Azine Series
1916–17	Prof. H. M. Dawson	The Phenomena of Acid Catalysis and the Theory of Acids
1917–18	L. G. Radcliffe	The Sulphonation of Fixed Oils
1918–19	C. F. Cross (Diplomas presented to M. C. Lamb and C. V. Greenwood as co-authors)	Colloidal Tannin Compounds and their Applications
1919–20	A. E. Everest (Diploma presented to A. J. Hall as co-author)	The Tinctorial Properties of some Anthocyans and certain Related Compounds
1920–21	Prof. G. T. Morgan	The Co-ordination Theory of Valency in Relation to Adjective Dyeing
1921–22	S. Judd Lewis	On the Fluorescence of Cellulose and its Derivatives
1922–23	Prof. Arthur G. Green (Bar) and K. H. Saunders	The Ionamines— A New Class of Dyestuffs for Cellulose Acetate Silk
1923–24	S. Judd Lewis (Bar)	The Quantitative Determination of the Fluorescent Power of Cellulose and its Derivatives
1924–25	Prof. F. M. Rowe (with Diploma to Miss E. Levin as co-author)	The Identification of Azo Colours on the Fibre and of Azo Pigments in Substance
1925–26	H. H. Hodgson	Behaviour of the Sulphides of Sodium in Aqueous and Alcoholic Media *and* The Action of Sulphur on the Monochloranilines
1926–27	Prof. F. M. Rowe (Bar) and Diplomas awarded to collaborators— Miss E. Levin, A. C. Burns, J. S. H. Davis, and W. Tepper	A New Reaction of Certain Diazosulphonates derived from β-Naphthol-l-sulphonic acid, leading to the preparation of Phthalazine, Phthalazone and Phthalimidine Derivatives
1928–29	F. Scholefield (with diplomas to Miss E. Hibbert and C. K. Patel as co-authors)	The Action of Light on Dyed Colours
1929–30	H. H. Hodgson (Bar)	Colour and Constitution from the Standpoint of Recent Electronic Theory
1930–31	Prof. F. M. Rowe (Second Bar) and Diplomas awarded to S. Ueno and F. H. Jowett as collaborators	Insoluble Azo Colours on the Fibre and Action of Boiling Caustic Soda thereon
1932–33	Two awards—	
	W. T. Astbury	The X-Ray Interpretation of Fibre Structure
	J. B. Speakman	The Structure of the Wool Fibre; its Relation to the Dyeing and Finishing Processes of the Wool Textile Trade
1934–35	H. A. Turner and Diplomas awarded to G. M. Nabar and F. Scholefield as co-authors	The effect of Reduced Vat Dyes upon the Hypochlorite Oxidation of Cellulose
1935–36	Prof. F. M. Rowe (Third Bar) and Diplomas awarded to C. H. Giles, R. L. M. Allen, W. G. Dangerfield, and Glyn Owen as collaborators	Decomposition of Azo Dyes by Acids, Caustic Alkalis, and Reducing Agents
1936–37	J. B. Speakman (Bar) and Diplomas awarded to C. S. Whewell and J. L. Stoves as collaborators	The Reactivity of the Sulphur Linkage in Animal Fibres

1937–38	Prof. F. M. ROWE (Fourth Bar) and J. B. SPEAKMAN (Second Bar) and Diplomas awarded to E. RACE and T. VICKERSTAFF as collaborators	The Unlevel Dyeing of Wool with Acid and Chrome Dyes. Part I—The Reasons for the Uneven Dyeing Properties of Wool Staples and of Cloth Damaged by Exposure, and Part II—A Method for Correcting the Uneven Dyeing Properties of Wool Staples and of Cloth Damaged by Exposure
1939–40	T. H. MORTON as senior author	Application of Vat Dyes to Viscose Rayon, by J. BOULTON and T. H. MORTON
1941–42	T. VICKERSTAFF as senior author	The Dyeing of Cellulose Acetate Rayon with Dispersed Dyes, by T. VICKERSTAFF and E. WATERS
1943–44	J. BOULTON	The Importance of Dyeing Rate—an Interpretation for the Practical Dyer of Recent Research on Direct Dyeing
1946–47	H. PHILLIPS as senior author	The Chemical Constitution and Physical Properties of Bisulphited Wool, by E. G. H. CARTER, W. R. MIDDLEBROOK, and H. PHILLIPS
1947–48	J. M. PRESTON	Some Factors affecting the Dyeing of Viscose *and* Some Aspects of the Drying and Heating of Textiles
1948–49	H. LINDLEY as major contributor	The Mechanism of Set and Supercontraction in Wool Fibres, by S. BLACKBURN and H. LINDLEY
1950–51	J. CRANK	The Diffusion of Direct Dyes into Cellulose. III—The Present State of the Theory and its Application
1951–52	H. HAMPSON	Advances in the Application of Vat Dyes to Viscose Rayon Cakes
1952–53	R. H. PETERS as senior author	The Reduction Properties of Vat Dyes, by W. J. MARSHALL and R. H. PETERS
1953–54	R. J. HANNAY as senior author	A New Method of pH Control in Dyeing and Some Observations on the Metachrome Process, by R. J. HANNAY, W. H. MAJOR, and R. PICKIN, *and* The Use of Hydrolysable Esters in the Control of Dyebaths, by R. J. HANNAY and W. H. MAJOR
1954–55	C. H. GILES as senior author	A Study of Certain Natural Dyes. I—The Adsorption of Brazilwood and Logwood Colouring Matters by Fibres, by F. M. ARSHID, J. N. DESAI, D. J. DUFF, C. H. GILES, S. K. JAIN, and I. R. MACNEAL, and II—The Structure of the Metallic Lakes of the Brazilwood and Logwood Colouring Matters, by F. M. ARSHID, R. F. CONNELLY, J. N. DESAI, R. G. FULTON, C. H. GILES, and J. C. KEFALAS
1955–56	C. L. BIRD as senior author	Series of papers on The Dyeing of Acetate Rayon with Disperse Dyes I–V, by C. L. BIRD, Miss P. HARRIS, F. MANCHESTER, and D. F. SCOTT
1956–57	K. MCLAREN	Series of papers on Light-fastness Testing and Fading of Dyes
1957–58	A. JOHNSON as senior author	Series of papers on The Chemistry of Esters of Leuco Vat Dyes

The Worshipful Company of Feltmakers Research Medal

The Feltmakers' Company offer annually a Gold Medal for papers embodying the results of scientific research or technical investigation connected with the art of feltmaking and published in the *Journal* of the Society.

Knecht Memorial Fund

A Fund of £100 was subscribed as a Memorial to the late Professor Edmund Knecht. From the interest on this sum two prizes, in the form of books, are awarded annually to selected students of the Manchester College of Science and Technology and the Royal Technical College, Salford.

Mercer Lecture

This lecture was instituted by an anonymous donor in commemoration of the centenary of the discovery of mercerisation.

1944	N. G. McCulloch and G. S. Hibbert	Science in an Old Industry
1945	G. S. J. White and T. Vickerstaff	Colour
1946	D. Entwistle	Regenerated Fibres from Natural Polymers
1947	E. J. Bowen	Colour and Constitution— The Absorption of Light by Chemical Compounds
1948	F. Farrington	Textile Printing
1949	E. Wilson	Some Applications of Chemistry to Textile Finishing
1950	A. B. Meggy	Some Recent Developments in the Theory of Dyeing
1951	D. Traill	Some Trials by Ingenious Inquisitive Persons— Regenerated Protein Fibres
1952	F. C. Wood	Non-felting Wool and Wool Mixtures
1953	J. R. Blockey and D. H. Tuck	The Coloration of Leather
1954	N. W. Yelland	Physics in the Dyeing, Printing, and Finishing Industries
1955	G. Landells	Modern Resin Finishing
1956	R. K. Fourness	Disperse Dyes— Their Development and Application
1957	J. S. Ward	The Influence of Fibre Types on Dyeing Methods

George Douglas Lecture

A sum of £2000 was given to the Society by the Bradford Dyers' Association Ltd., the income from the investment of which is employed in providing a biennial lecture on some subject connected with the colouring or finishing of textiles.

1949	H. Levinstein	George Douglas, His Times, and Some Thoughts on the Future
1952	R. Hill	Synthetic Fibres in Prospect and Retrospect
1953	T. Holbro	The Search for New Dyes in relation to Modern Developments in the Textile Field
1957	G. S. J. White	Dyeing— The Apotheosis of Synthesis or a Team playing for its Colours against White
1958	W. Gutmann	Textile Finishing— Problems of Today and Tomorrow

Proceedings of the Society

The Determination of Damage to Wool Fibres

J. C. BROWN

Meetings of the London Section held jointly with the London Centre of the Guild of Dyers and Cleaners at Burlington House, London, on 4th November 1955, Dr. H. W. Ellis in the chair; of the Bradford Junior Branch, held at the Technical College, Bradford, on 8th November 1955, Mr. G. F. C. Fathers in the chair; and of the Scottish Junior Branch, held at the Technical College, Paisley, on 3rd December 1957, Mr. C. McNeil in the chair

Tests for chemical damage to the wool fibre are classified according to the type of modification measured. Microscopical and staining tests are discussed, and a new test for alkaline damage is described. The swelling of wool fibres in aqueous buffer solutions has been accurately measured using a centrifuge technique under easily reproducible controlled conditions. Rupture of disulphide bonds by alkaline modification has been shown to lead to a rapid increase in percentage swelling, which can be used as a measure of damage. A slight proportional decrease in swelling capacity results from dyeing, and an interesting distinction has been made between neutral-dyeing metal-complex dyes and other types of wool dyes. Chrome dyeings possess greater resistance to alkaline attack than undyed wools.

Introduction

One of the most common enquiries received by a technical service department dealing with the wool industry is a request for information on the amount of modification or damage suffered by a sample. Wool is almost unique among fibres in that its complicated physical and chemical structure renders it susceptible to change when brought into contact with almost any kind of chemical reagent, not excluding distilled water. Many industrial treatments vary in effect according to the previous history of a sample, and the value of some reliable system of measurement of fibre modification is obvious. Some progress has been made towards establishing such a system, but many of the tests now in use are empirical in nature, and do not necessarily measure a particular fundamental fibre characteristic. This paper attempts to review some of the existing tests from this standpoint, and describes in detail a new test for the recognition of damage to the disulphide linkages of the wool fibre.

Classification of Tests for Fibre Damage

In an attempt to classify the various tests for fibre damage, they have been divided into the following broad groups according to the type of chemical or physicochemical modification which they are capable of detecting—

1. TESTS FOR MODIFICATION OF OUTER SURFACE STRUCTURE
   - (*a*) Direct microscopical examination
   - (*b*) Sellotape technique
   - (*c*) Many staining tests
   - (*d*) Allwörden reaction.
2. TESTS FOR DISULPHIDE BOND RUPTURE
   - (*a*) Percentage swelling test
   - (*b*) Urea–bisulphite solubility test*.
3. TESTS FOR MAIN-CHAIN DEGRADATION
   - (*a*) Alkali solubility test
   - (*b*) Urea–bisulphite solubility test
   - (*c*) Krais–Viertel (K.M.V.) test.
4. TESTS FOR MISCELLANEOUS TYPES OF DAMAGE INVOLVING COMBINATIONS OF THE ABOVE
   - (*a*) Microscopical techniques.

* The urea–bisulphite solubility test appears to be valuable both as a test for disulphide-bond rupture and for main-chain hydrolysis, but for the sake of convenience both aspects will be discussed under § 3.

(1) Tests for Modification of Outer Surface Structure

THE SELLOTAPE METHOD OF MICROSCOPIC EXAMINATION

It has long been recognised that the microscopical appearance of the imbricated scale structure of the wool fibre changes with chemical modifications to the fibre.

It is, however, very difficult to study the fibre surface closely, which is not surprising if we bear in mind that the limit of resolution of the optical microscope is about 0·2 μ, under normal conditions and the thickness of the entire cuticle cell itself is only about 1 μ. Fig. 1, a photomicrograph of wool mounted normally in water, illustrates the difficulty. The scale structure is visible but not pronounced. Various techniques have been developed, however, for "half-embedding" fibres so that one half of the fibre is in contact with air and the other half embedded in some suitable medium having a refractive index similar to that of the fibre[1]. The simplest version of this method employs ordinary Sellotape strip (Adhesive Tapes Ltd.) as suggested by Herzog[2]. Fig. 2 shows an unchanged merino wool fibre which had been laid on a slide and attached to it with Sellotape using gentle pressure. The fibre was photographed through the Sellotape, no cover glass being used, and the clarity of the resultant image is due to two factors: there is firstly a large change in refractive index at the surface being examined, which shows up every detail; and secondly the top surface, being invisible, does not interfere with the image of the bottom one.

Fig. 3 and 4 show fibres examined by this technique taken from a sample of wool which had been boiled for 80 min. in a buffer solution at pH 9·2. Fig. 3 shows a fibre with slight damage, the scales being not quite as pronounced as in Fig. 2, and in addition there are several longitudinal

wrinkles in the surface, which seem to be characteristic of fibres which have had a prolonged treatment with mild alkali. Fig. 4 is a photomicrograph of a fibre, from the same treated sample, which has suffered very severe damage. The scale structure is still almost completely intact, but very pronounced longitudinal wrinkles have developed. These are visible on some fibres when examined by normal methods, but this technique enables them to be seen far more clearly.

The effectiveness of many chlorination shrink-resistant treatments depends on their ability to degrade the outer surface of the fibre and modify the natural scale structure, so interfering with the felting process, which is considered to be dependent on this. Inadequate technical control of the conditions of this reaction in commercial operation frequently leads to severe damage, particularly to the outside fibres of a sample, and this local over-chlorination can often be recognised microscopically.

Fig. 5 illustrates a fibre damaged by chlorine from acidified hypochlorite at pH 2·0 without the use of any rate-controlling chemical such as would normally be employed in commercial practice. The scale edges are now rather more ragged and indistinct.

Some fibres are damaged to the extent of almost complete removal or masking of the scales, as will be seen from Fig. 6, showing a fibre taken from the same experiment. Even under the most carefully controlled conditions a very uneven reaction with the fibres can occur, probably due in no small measure to the natural variability of the fibres themselves, which will be emphasised at each successive stage in processing.

This variability from fibre to fibre is a fundamental difficulty in all microscopical tests. An attempt can be made to overcome it by carrying out a count of about 200 fibres under the microscope using the Sellotape technique, and classifying them as— undamaged, slightly damaged, damaged, or very severely damaged, the last stage implying complete scale removal. The results in Table I were obtained in investigating the effect of over-chlorination in the Melafix shrink-resistant process, such as might result from very poor technical control in commercial application.

At 2% chlorine some 80% of the scale structure has been either slightly damaged or damaged, this being a necessary requirement for shrink-resistant properties. The increase in severely damaged fibres at 2% chlorine is negligible. The bottom row of figures shows what happens if the process is applied without the addition of Melafix CH. There is an increase in both undamaged and very severely damaged fibres, indicating a very uneven reaction. This method of assessing scale damage would be very difficult to apply with ordinary mounting techniques, and the Sellotape method seems to offer a distinct advantage where fine surface structure is to be investigated.

STAINING TESTS

A great number of staining tests for wool damage have been suggested in the past, but very few can be considered as in any way specific for particular types of damage. It must now be accepted that in many cases the amount of staining is dependent more on the degree of modification to the surface structure rather than on any change in affinity of the fibre as a whole for the particular stain.

A good example of this is the use of Kiton Fast Red G (C.I. Acid Red 1) as a stain for fibre damage, as this dye penetrates only where the outer surface has been modified or removed. This is shown in Fig. 7, which is a photomicrograph of mechanically damaged wool fibres removed from the Martindale abrasion machine during the testing of wool cloth and stained with Kiton Fast Red G. Mechanical damage is usually characterised by fibrillation of the fibre, especially at the ends, and this can be seen clearly in Fig 8, which shows a fibre taken from the same sample, and examined at a higher magnification. This tendency of the cortical cells to separate with mechanical treatment is greatly accelerated by acid damage. In fact it is not uncommon to find light patches on severely acid-damaged cloth, due to intercellular disintegration. Very often these light patches result from mechanical subdivision and are not, as is often thought, due to decreased absorption of the dyes.

A few stains are specific for a particular type of damage. A dilute solution of Methylene Blue G (C.I. Basic Blue 9) slightly acidified with acetic acid, for instance, will stain chlorinated wool heavily, whereas untreated wool and wool damaged by acids and alkalis shows only very slight staining.

THE ALLWÖRDEN REACTION

The remaining test concerned with surface modifications is based on a most interesting reaction first described by Allwörden in 1916[3]. When normal wool is immersed in chlorine water or bromine water there is a rapid reaction which

TABLE I

Sellotape Examination of the Effect of Increasing Chlorine Concentration (%) on Scale Modification

(% of fibres undamaged, etc.)

	Treatment	pH	Undamaged	Slightly Damaged	Damaged	Very Severely Damaged
(1)	Untreated wool	—	59	27	12	2
(2)	1% Cl + Melafix CH	2·0	41	34	22	3
(3)	1·5% Cl + Melafix CH	2·0	31	31	35	3
(4)	2% Cl + Melafix CH	2·0	13	40	43	4
(5)	3% Cl + Melafix CH	2·0–2·3	9	31	52	8
(6)	4% Cl + Melafix CH	2·0–2·3	8	21	57	14
(7)	2% Chlorine	—	21	20	27	32

produces after a few minutes a series of bubbles or blisters on the surface. The mechanism of this reaction is now becoming clear with the discovery of the different component parts which make up the cuticle cell. The K1 layer or exocuticle, described by Mercer and Rees [4] and by Lindberg *et al.*[5], presumably reacts with halogens to give soluble degradation products of high molecular weight, incapable of passing the epicuticle, which behaves osmotically as a semi-permeable membrane. The result is a bubble emanating from each scale, which is rendered visible by containing a liquid of higher refractive index, as shown in Fig. 9.

A detailed procedure for this and other tests is laid down by Meeuse *et al.*[6]. This entails timing the appearance of these bubbles under the microscope and comparing this reaction time with that of undamaged fibres of the same fineness. Alkali damage is recognised by a much longer reaction time, and acid damage leads to the production of bubbles in a very few seconds.

Fig. 10 is a photomicrograph of wool which has been boiled for 80 min. at pH 9·2 and subjected to the Allwörden reaction; even after some 20 min. in the reagent no bubbles have appeared. The fibres have not been dyed yellow: the colour is due in all probability to bromination of the tyrosine side-chains of the protein molecule in the bulk of the material. Meeuse states [6] that, assuming intact scales to be present, bubbles are always formed eventually, but obviously the Allwörden reaction would be impossible if either the epicuticle or the exocuticle were to be destroyed completely.

The Allwörden reaction has been found very useful for detecting fairly severe alkali damage, but the experimental difficulties make the detection of slight damage very uncertain.

(2) Test for Disulphide Bond Rupture

THE PERCENTAGE SWELLING TEST

The keratinoid group of proteins, of which wool is an example, possess in common the characteristic of extreme insolubility, which results from the numerous stable covalent cross-linkages arising from the high proportion of cystine in the molecule. No success has ever rewarded the attempts of those who have endeavoured to obtain solutions of wool which are not degraded chemically. The swelling properties of wool also depend primarily on the cystine linkages, although some measure of restraint may be exercised by the electrovalent "salt" linkages between charged ionic sites in neighbouring polypeptide chains. Any rupture of the disulphide cross-link, such as is known to occur as the result of alkaline damage, will immediately affect the swelling properties of the fibre. The fact that stable sulphide cross-linkages may be subsequently formed, as first conclusively proved by Horn, Jones, and Ringel [7], does not materially affect this argument, since there is opportunity for molecular rearrangement to take place before the formation of the new swelling-restricting groups.

The possibility of estimating fibre damage by swelling measurements has attracted workers in the past, but emphasis has been laid almost entirely on microscopical techniques. Von Bergen [8] in 1925 used the increased swelling in caustic soda as a measure of damage and employed direct fibre diameter measurement. The inevitable drawbacks to any microscopical approach, such as the dependence of the results on fibre quality, the great difficulty of obtaining representative fibres, and the limited accuracy, have meant that the method has not been adopted extensively. The percentage swelling can also be measured accurately by weighing before and after drying if the interfibre water can be removed. The amount of water which is held by interfibre capillary attraction is dependent on many complex factors, such as the gravitational field operating on the sample, the interfacial tension between the water and the fibre, and the bulk density of the fibre sample. The influence of factors such as these on the quantity of water retained has been studied by Preston *et al.*[9], and the subject has received sufficient attention to enable one to decide on conditions for centrifuging which will leave only very small and constant amounts of interfibre water. The use of a wetting agent helps considerably in this respect.

Detailed Procedure

The sample should first be disintegrated into small pieces. It is suggested that yarn be cut into $\frac{1}{2}$-in. lengths, and pieces into small squares $\frac{1}{4}$ in. $\times$ $\frac{1}{4}$ in. Enough material should be taken to give about 1 g. of wool. Each sample is then placed in a 50-ml. beaker, which is filled with a buffer solution of the following composition, during which operation a glass rod may be employed to assist the material to wet out—

NaH_2PO_4	6·26 g.
Na_2HPO_4	0·95 g.
Invadine JFC type strength (non-ionic wetting agent)	2·00 ml.
Water	to 1000 ml.

The samples are left in this solution, which should have a pH of 5·95 at 20°C., for 1 hr. While the samples are attaining equilibrium swelling, small standard 15-ml. centrifuge tubes are prepared as follows—

The bottom 2 in. of the tube is filled with absorbent cotton-wool rammed down tight with a glass rod. The exact amount is not important, but it should be the same in each test. A small circle of filter paper (conveniently manufactured from a wad of filter papers, using a cork borer) is then introduced, and the tube is fitted with a cork (Fig. 11).

After 1 hr. immersion in the buffer solution, the samples are blotted twice between filter paper to remove excess liquid, and introduced into the prepared tubes. The tubes are then centrifuged at 1,200 *g* for exactly 15 min. The centrifuge must be a reasonably good one fitted with an accurate tachometer, and to obtain this centrifugal field a speed of 3,000 r.p.m. was employed, this being maintained constant by means of a variable resistance in the current supply to the motor. The speed required will depend on the distance of the

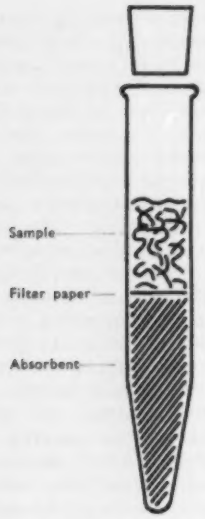

FIG. 11— Tube for Measurement of Swelling

samples from the centre of the centrifuge in the particular instrument used. This should be measured, and the speed required calculated from the simple formula—

$$N = 298\sqrt{\frac{F}{r}}$$

where F is the gravitational factor required, r cm. the distance of the sample from the axis, and N the number of revolutions per minute.

After centrifuging, the tubes are withdrawn one by one from the instrument, and the wool samples introduced without delay into weighing bottles fitted with ground glass stoppers. Up to this point it is not necessary to be careful about retaining every portion of the samples, as these have not yet been weighed, but they must not be given any opportunity to lose moisture to the atmosphere. The weighing bottles are next weighed, giving the amount of fibre and absorbed water, dried for at least 4 hr. at 110°C., and weighed again, giving the dry weight of the fibre. A typical series of results is given in Table II.

TABLE II

Weighing bottle + centrifuged wool (a)	16·1654 g.
Weighing bottle + dried wool (b)	15·8461 g.
Weighing bottle (c)	15·0033 g.
Absorbed water ($a-b$)	0·3193 g.
Dry weight ($b-c$)	0·8428 g.
Swelling $\left(\frac{a-b}{b-c} \times 100\right)$	37·9%

Experimental Verification of Conditions

The effect on the percentage swelling of varying the experimental conditions has been studied. The same sample was measured at centrifuge speeds corresponding to a wide range of gravitational fields (Table III).

The variation obtained is small, and the use of standard conditions as suggested should easily reduce this to negligible proportions. The results

TABLE III

Centrifuge Speed (r.p.m.)	Gravitational Field (g)	Swelling (%)
1500	291	40·0
2000	514	38·5
2500	799	37·7
3000	1160	36·7
3500	1590	36·0

in Table IV show the change in swelling with time of centrifuging, and 15 min. was selected as a suitable value.

TABLE IV

Time of Centrifuging (min.)	Swelling (%)
2·5	38·3
5	36·9
10	35·9
15	35·5
20	35·0
30	35·0

The composition of the buffer solution used was varied with a view to finding the effect of pH on the swelling (Table V).

TABLE V

pH of Buffer Solution	Swelling (%)
5·2	35·1
5·7	35·1
6·0	34·9
6·3	35·6

It has been found in practice that the buffer solution remains at a constant pH even when samples containing small amounts of acid and alkali are used. Under the conditions selected the reproducibility of results was excellent. The two samples in Table VI were tested on six different occasions by three different operatives.

TABLE VI

	Sample A Swelling (%)	Sample B
Test 1	38·4	35·0
Test 2	38·6	35·3
Test 3	38·2	34·8
Test 4	38·8	34·3
Test 5	39·6	34·8
Test 6	38·6	34·7
Standard deviation	0·481	0·33

The reproducibility would seem to be rather better than that achieved by Lindberg [10], who has carried out some similar tests as confirmatory evidence to support other work. The conditions chosen differed from those described here in at least one respect, and somewhat different values were obtained.

If the test is applied to fibres known to have no water-imbibing properties, the swelling obtained will represent the adsorbed surface water and gives a rough indication of the efficiency of the centrifuging process for other fibres. Both Terylene and glass fibres gave a value of 0·5% swelling under the normal conditions of the test, indicating almost complete removal of external water from these fibres.

Variation with Fibre Quality

The vast majority of tests for fibre damage entail simultaneous measurement on undamaged fibres of the same fineness or quality if any quantitative evaluation is to be made. The following example [6] gives the variation in "reaction time" of differing wool samples for the Allwörden reaction—

Fine wool	30 sec.
Wool of medium fineness	70–80 sec.
Coarse wool	120 sec.

The effect of this order of variation on the reliability of the method needs no emphasis. Remarkably constant values have been obtained by the percentage swelling test on widely differing qualities of wool. The results in Table VII were obtained on four samples of solvent-degreased raw wools, and this constancy of swelling has been observed with many other samples from widely differing sources. It is obviously of great practical significance.

TABLE VII

Wool Fineness	Swelling (%)
48s	39·1
56s	37·5
60s	37·8
64s	36·8

Effectiveness of Percentage Swelling as a Measure of Damage

The effect of alkali modification on the change in swelling has been studied for a wide range of conditions, some of which can be related to commercial operations such as wool scouring, where the possibility of alkali damage is always present. Alkalis rapidly rupture the cystine disulphide cross-linkages, and in all cases the swelling rises rapidly with duration and increasing severity of treatment. Fig. 12 illustrates the increase in swelling for wool treated at pH 9·25 (measured at 20°C.) at 60°, 80°, and 100°C. Even under the comparatively mild conditions of the lowest temperature at this pH it is possible to detect some modification to the swelling properties. At 100°C. the increase of swelling with time of treatment is very rapid, and with prolonged treatment very high figures are obtained.

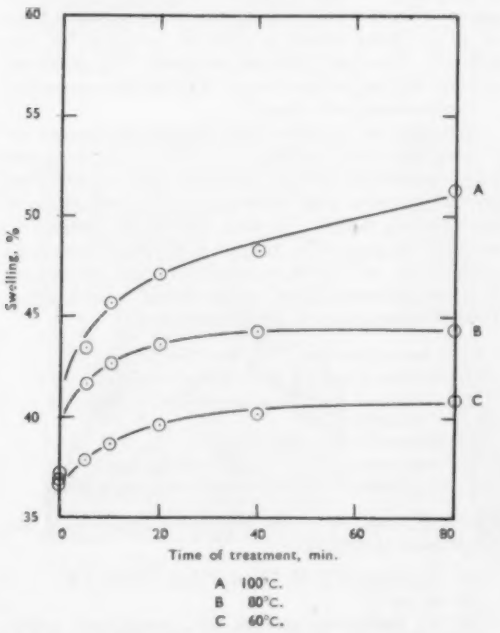

Fig. 12— Effect of Temperature on Swelling (fine worsted hosiery yarn treated with 0·05 M. borax, pH 9·25)

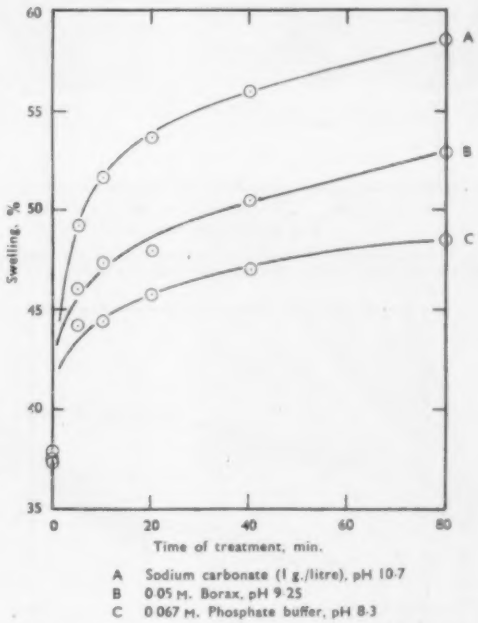

Fig. 13— Effect of pH on Damage (fine worsted hosiery yarn treated at 100°C.)

The amount of damage also increased very rapidly with the pH of treatment, this being illustrated in Fig. 13 for a pH range of 8·3–10·7 (measured at 20°C.). It is obvious that even mild alkaline conditions can cause appreciable damage at the boil.

Acid damage, which can be regarded as hydrolysis of the protein main chain, has little effect on combined cystine; hence, as can be seen from curve A in Fig. 14, the swelling increases only slightly even with severe treatment. This fact makes the percentage swelling test specific for cystine disulphide bond rupture, which enhances its usefulness considerably. The identification of damage to wool is complicated by the fact that in commercial practice the fibre may be subjected to several successive different chemical treatments. After scouring and carbonising, for instance, the fibre may have suffered alkaline and acid damage successively. Very few tests have been developed which are specific for a particular type of damage irrespective of what other treatment the material may have suffered.

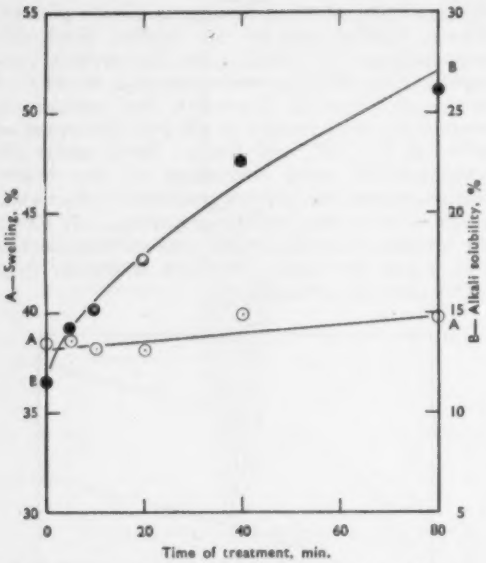

FIG. 14— Insensitivity of Percentage Swelling Test to Acid Damage (neutralised wool treated with sulphuric acid (2 g./litre) at 100°C.)

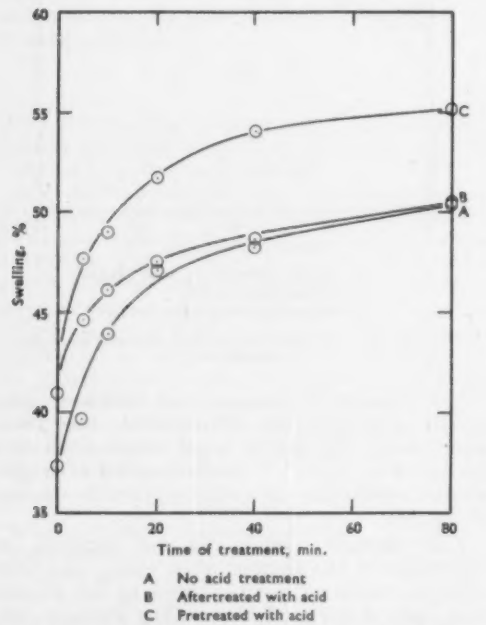

FIG. 15— Effect of Acid Treatment on Swelling due to Alkali (fine worsted hosiery yarn treated with 0·05 M. borax, pH 9·25; sulphuric acid (1 g./litre) at 100°C. for 2 hr.)

Fig. 15 illustrates the effect on swelling of alkaline damage which has been either preceded or followed by acid damage. The samples were treated with sulphuric acid (1 g./litre) before or after alkaline treatment at pH 9·25 for varying times.

Curve A indicates the increase in swelling for alkaline damage alone, and curve B the increase when this damage is followed by an acid boil. The curves are similar, especially in the later stages of alkaline attack. If alkali damage is preceded by acid damage (curve C), a greater increase in swelling is observed. These observations suggest that the percentage swelling test is capable of measuring alkaline damage even if this has been followed by acid attack. In the case of acid damage preceding alkaline damage, the results would seem to indicate that acid attack sensitises the fibre to alkaline attack. This is in agreement with the generally recognised fact that acid-damaged wool is less resistant than normal wool to further processing.

Effect of Amount of Dye present

Abnormally low results were obtained on samples dyed to full colours with chrome dyes. For example, sample B (Table VI) had been dyed black with Chrome Fast Black CAT (C.I. Mordant Black 11), afterchromed in the usual manner. The hypothesis first considered was that the dichromate had a "tanning" effect on the wool protein in a somewhat analogous fashion to that on leather, producing stable covalent cross-linkages which would restrict the swelling of the fibre. Some additional facts tended to support this hypothesis. Firstly it had been stated by Meeuse [6] that the results obtained in the K.M.V. or Krais–Viertel microscopic test for acid damage can be affected by the presence or otherwise of chromium on the material, and the same phenomenon seems to have been observed with the Allwörden test [6]. Both these tests are essentially swelling tests, and would be affected by stable covalent cross-linkages. Secondly, it has been found that chrome-dyed wools have a greater resistance to alkaline attack than undyed wools, and it can be argued that this is the direct result of covalent cross-linkages. It is proposed to touch on this matter later in the paper. Thirdly, measurements of supercontraction of wool fibres show a definite increase in the recovery time for increased amounts of dichromate applied during afterchrome treatments according to Rzegocinski and Lund [11].

Attempts to correlate the amount of chrome on a dyed fibre with the reduction in swelling were not very successful, and it was also discovered that heavy depths of acid dyes produced a reduction in the swelling figure. It was, therefore, decided to produce dyeings of a range of different strengths from 1·0% to 10·0% under identical or almost identical pH conditions, and measure their swelling. The following dyes were investigated—

(1) Cibalan Red 2GL (C.I. Acid Red 211)
(2) Cibalan Green GL (C.I. Acid Green 43)
(3) 2-Amino-4-chloro-6-sulphophenol→β-naphthol (afterchromed)
(4) Orange II (C.I. Acid Orange 7)
(5) Naphthionic acid→6-sulpho-2-naphthol
(6) Naphthionic Acid→3:6-disulpho-2-naphthol.

The following were the additions made and the conditions of dyeing—

(1) 2%$(NH_4)_2SO_4$, 50:1 liquor ratio, 100°C., 1 hr.
(2) As (1)
(3) 3% Acetic acid (glacial), 50:1 liquor ratio, 100°C., 1 hr., afterchromed with 1% sodium dichromate (2% for 8% dyeing)

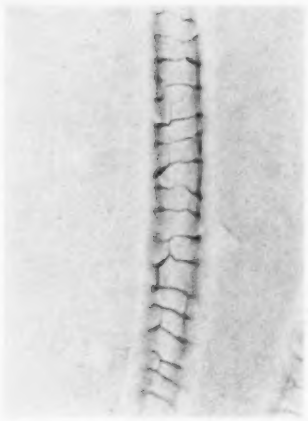

FIG. 2—Undamaged Merino Fibre—Sellotape Method

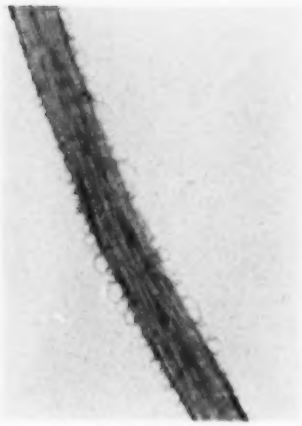

FIG. 9—Allwörden Reaction—Undamaged Wool Fibre

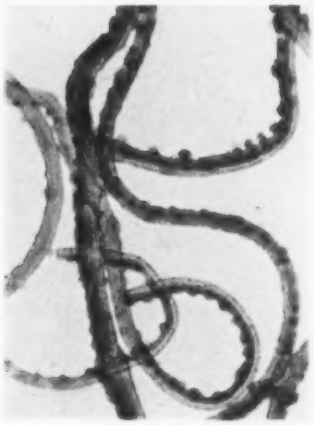

FIG. 22—Krais–Viertel (K.M.V.) Reagent—Acid-damaged Wool Fibre

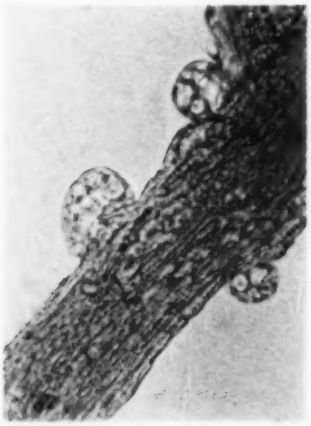

FIG. 24—Krais–Viertel (K.M.V.) Reagent—Structure of Swelling in Acid-damaged Wool Fibre

FIG. 28—Mildewed Wool Fibres stained with Kiton Fast Red G

FIG. 8—Mechanically Damaged Wool Fibre (Martindale Tester) stained with Kiton Fast Red G

FIG. 29—Counterstained Mildewed Wool Fibre (Kiton Red Fast G and Victoria Blue)

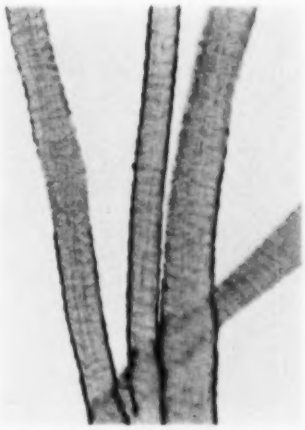

FIG. 10—Allwörden Reaction—Alkali-damaged Wool Fibre

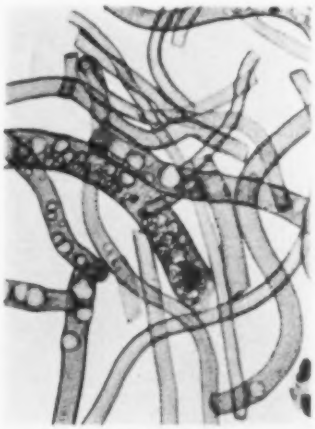

FIG. 25—Scorched Wool Fibre

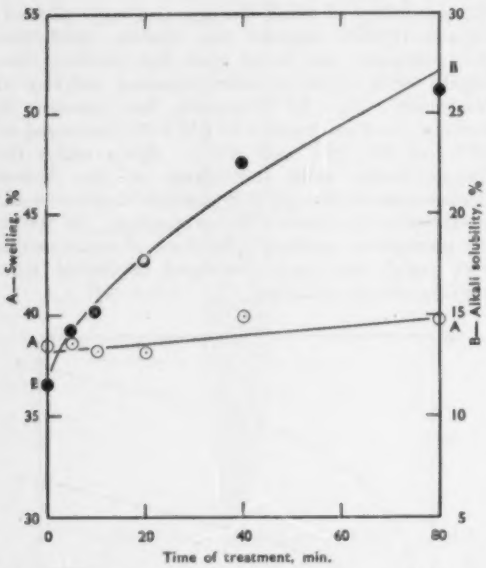

FIG. 14— Insensitivity of Percentage Swelling Test to Acid Damage (neutralised wool treated with sulphuric acid (2 g./litre) at 100°C.)

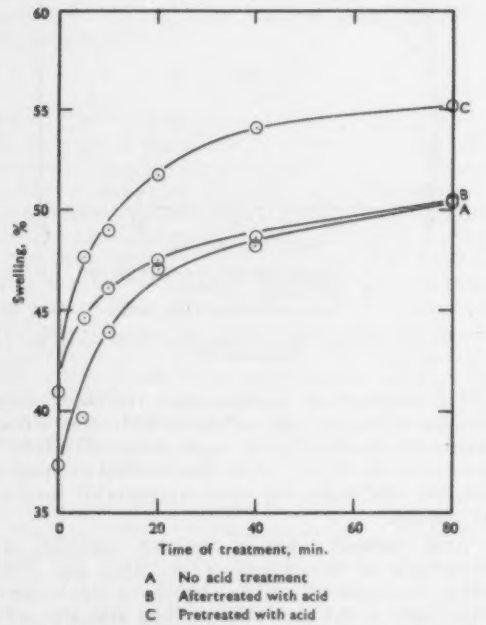

FIG. 15— Effect of Acid Treatment on Swelling due to Alkali (fine worsted hosiery yarn treated with 0·05 M. borax, pH 9·25; sulphuric acid (1 g./litre) at 100°C. for 2 hr.)

Fig. 15 illustrates the effect on swelling of alkaline damage which has been either preceded or followed by acid damage. The samples were treated with sulphuric acid (1 g./litre) before or after alkaline treatment at pH 9·25 for varying times.

Curve A indicates the increase in swelling for alkaline damage alone, and curve B the increase when this damage is followed by an acid boil. The curves are similar, especially in the later stages of alkaline attack. If alkali damage is preceded by acid damage (curve C), a greater increase in swelling is observed. These observations suggest that the percentage swelling test is capable of measuring alkaline damage even if this has been followed by acid attack. In the case of acid damage preceding alkaline damage, the results would seem to indicate that acid attack sensitises the fibre to alkaline attack. This is in agreement with the generally recognised fact that acid-damaged wool is less resistant than normal wool to further processing.

Effect of Amount of Dye present

Abnormally low results were obtained on samples dyed to full colours with chrome dyes. For example, sample B (Table VI) had been dyed black with Chrome Fast Black CAT (C.I. Mordant Black 11), afterchromed in the usual manner. The hypothesis first considered was that the dichromate had a "tanning" effect on the wool protein in a somewhat analogous fashion to that on leather, producing stable covalent cross-linkages which would restrict the swelling of the fibre. Some additional facts tended to support this hypothesis. Firstly it had been stated by Meeuse [6] that the results obtained in the K.M.V. or Krais–Viertel microscopic test for acid damage can be affected by the presence or otherwise of chromium on the material, and the same phenomenon seems to have been observed with the Allwörden test [6]. Both these tests are essentially swelling tests, and would be affected by stable covalent cross-linkages. Secondly, it has been found that chrome-dyed wools have a greater resistance to alkaline attack than undyed wools, and it can be argued that this is the direct result of covalent cross-linkages. It is proposed to touch on this matter later in the paper. Thirdly, measurements of supercontraction of wool fibres show a definite increase in the recovery time for increased amounts of dichromate applied during afterchrome treatments according to Rzegocinski and Lund [11].

Attempts to correlate the amount of chrome on a dyed fibre with the reduction in swelling were not very successful, and it was also discovered that heavy depths of acid dyes produced a reduction in the swelling figure. It was, therefore, decided to produce dyeings of a range of different strengths from 1·0% to 10·0% under identical or almost identical pH conditions, and measure their swelling. The following dyes were investigated—

(1) Cibalan Red 2GL (C.I. Acid Red 211)
(2) Cibalan Green GL (C.I. Acid Green 43)
(3) 2-Amino-4-chloro-6-sulphophenol→β-naphthol (afterchromed)
(4) Orange II (C.I. Acid Orange 7)
(5) Naphthionic acid→6-sulpho-2-naphthol
(6) Naphthionic Acid→3:6-disulpho-2-naphthol.

The following were the additions made and the conditions of dyeing—

(1) 2% $(NH_4)_2SO_4$, 50:1 liquor ratio, 100°C., 1 hr.
(2) As (1)
(3) 3% Acetic acid (glacial), 50:1 liquor ratio, 100°C., 1 hr., afterchromed with 1% sodium dichromate (2% for 8% dyeing)

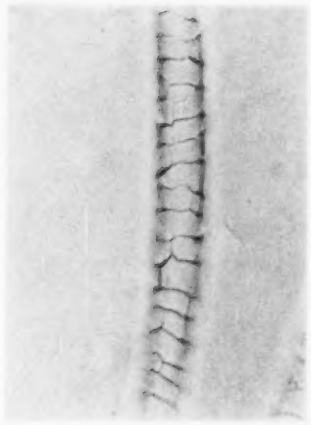

FIG. 2—Undamaged Merino Fibre—Sellotape Method

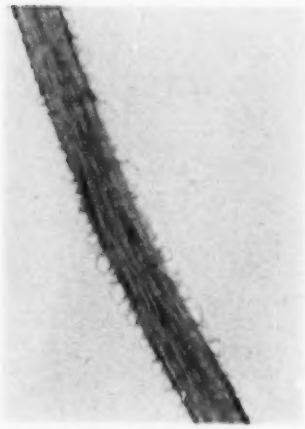

FIG. 9—Allwörden Reaction—Undamaged Wool Fibre

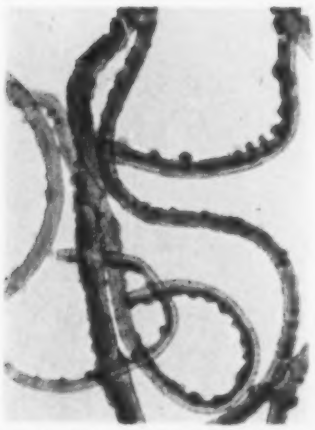

FIG. 22—Krais–Viertel (K.M.V.) Reagent—Acid-damaged Wool Fibre

FIG. 24—Krais–Viertel (K.M.V.) Reagent—Structure of Swelling in Acid-damaged Wool Fibre

FIG. 28—Mildewed Wool Fibres stained with Kiton Fast Red G

FIG. 8—Mechanically Damaged Wool Fibre (Martindale Tester) stained with Kiton Fast Red G

FIG. 29—Counterstained Mildewed Wool Fibre (Kiton Red Fast G and Victoria Blue)

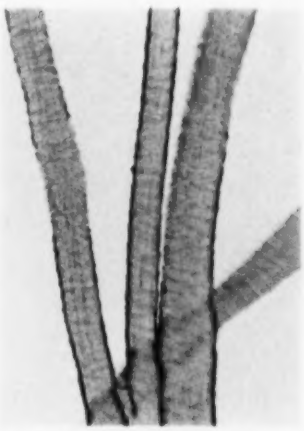

FIG. 10—Allwörden Reaction—Alkali-damaged Wool Fibre

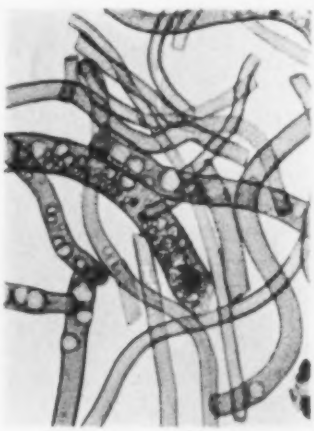

FIG. 25—Scorched Wool Fibre

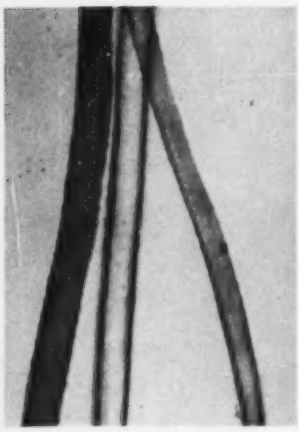

FIG. 1— Wool Fibres in water

FIG. 3— Slightly Alkali-damaged Wool Fibre (pH 9·25, 100°C., 80 min.)

FIG. 4— Severely Alkali-damaged Wool Fibre (pH 9·25, 100°C., 80 min.)

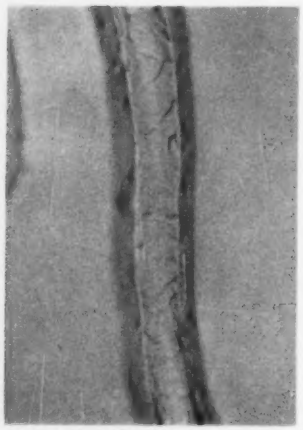

FIG. 5— Slight Hypochlorite Damage— Sellotape Method

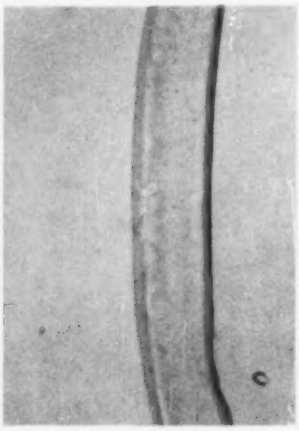

FIG. 6— Severe Hypochlorite Damage— Sellotape Method

FIG. 7— Mechanically Damaged Wool Fibre (Martindale Tester) stained with Kiton Fast Red G

FIG. 23—Krais-Viertel (K.M.V.) Reagent— Acid-damaged Wool Fibre

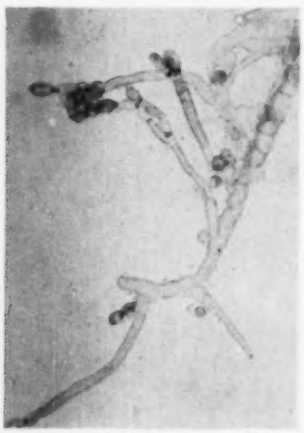

FIG. 26— Micro-organism from Mildewed Wool Fibre

FIG. 27— Mildewed Wool Fibres stained with Kiton Fast Red G

(4) Liquor ratio 75:1, 100°c., 1 hr. under reflux; dyeing maintained at pH exactly 3·30 (measured at the boil, see below) by addition of 1% solution of sulphuric acid as required
(5) As (4)
(6) As (4).

The samples used were either specially prepared or commercial dyes of the highest available purity, and these were estimated colorimetrically (using a Hilger Spekker absorptiometer) against carefully purified and salt-free samples prepared in the laboratory.

Under the conditions of the first three ranges the pH variations were approximately the same for each dyeing, and no special control was introduced, but in the case of the acid dyes (4)–(6) dyeing was associated with progressive uptake of sulphuric acid to neutralise the sodium ions produced, particularly with the heavy depths of the trisulphonate dye (6). Varying pH conditions with different depths would, therefore, result in different degrees of modification to the wool, which would mask the changes in swelling brought about directly by the presence of the dye. To obviate this the pH of the boiling dyebath was measured directly with a high-temperature glass electrode (Electronic Instruments Ltd., No. GHS 23) standardised against potassium hydrogen phthalate at the boil (pH 4·24).

Dyeing was commenced, therefore, with the addition of 1·0–2·5% sulphuric acid (on the weight of material) according to the amount of dye being applied, and further acid was run into the bath as dyeing proceeded to maintain the pH between 3·28 and 3·32.

Reduction in Swelling

The dyeings of each range described above were then tested comparatively for swelling, and the results are plotted against amount of dye on the fibre in Fig. 16; in addition two theoretical curves A and B have also been plotted. Curve A indicates the slope that results from assuming that the only effect of the dye is to increase the weight of the sample and that it takes no part in the swelling process. The "dry weight" of wool will then be in error by the weight of dye applied, and in the quotient $(a-b)/(b-c)$ (Table II) the denominator should be decreased by this amount to obtain the true result relating to the wool fibre alone. Without this correction a lower figure is obtained, and curve A shows the variations of this with increasing amounts of dye. Curve B is deduced by treating the system as one of water-filled interstices from which water is displaced by entry of the dye, which is assumed to have a molecular density of 1·2. The volume of dye present is assumed to displace an equal volume of water, and so reduce the swelling by that amount. On this view the effect is also one proportional to the weight of dye added, but the curve obtained is rather steeper.

It will be readily seen that the two Cibalan dyes give curves with slopes which agree very closely with that of theoretical curve A. The actual ordinate intersection is unimportant, depending as it does on the experimental difference between series of swelling tests. The chrome dyes and the various acid dyes all give curves with similar

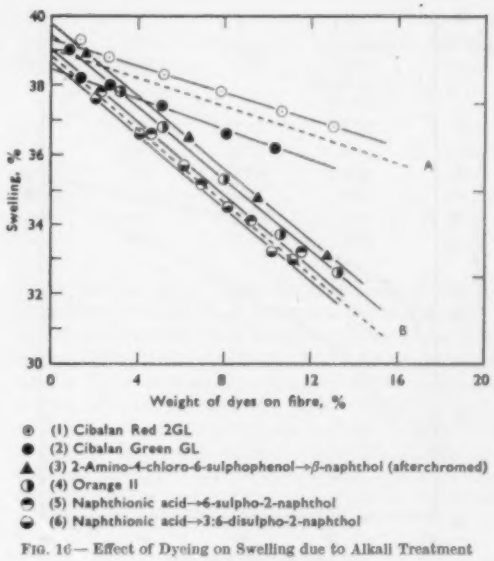

FIG. 16— Effect of Dyeing on Swelling due to Alkali Treatment

slopes, and these agree well with the theoretical curve B. This is in spite of the difference in molecular weight and degree of sulphonation of the dyes, and proves that the effect on the swelling is independent of the mechanism of dyeing or the number of dye sites occupied, and can be regarded purely as a displacement of the water held in the "micro-capillary" or "amorphous" regions of the fibre. It can only be assumed that the Cibalan dyes do not enter or do not finally reside in this system, and that apart from the mass effect of their presence they do not affect the water-imbibing properties of the fibre at all.

From the practical point of view of interpreting percentage swelling figures when small differences are being evaluated, a correction could be applied for medium and heavy depths. This will be small, and its estimation will depend on a knowledge of the actual dye concentration on the fibre. This will not be the same as the depth of the particular commercial sample used. Only with full blacks, where it is common practice to employ relatively large amounts of dye, will the decrease in swelling approach 4·0%. In such cases this could be added to the experimental figure obtained.

Resistance to Alkali of Chrome-dyed Wool

The dyeing of wool with chrome dyes results in the production of tervalent chromium ions within the fibre at some stage of the process, and these should be capable of cross-linking the wool protein to some extent with stable covalent bonds in a manner somewhat analogous to the tanning of leather. First considerations suggest the possibility of detecting these by means of the swelling test, but, as we have seen, the only reduction obtained is satisfactorily explained as due to the entry of the dye and the chromium into the fibre. However, if we consider that cross-linkages will restrict swelling only if the fibre is subjected to more severe conditions than those under which these linkages were introduced, we see that it would

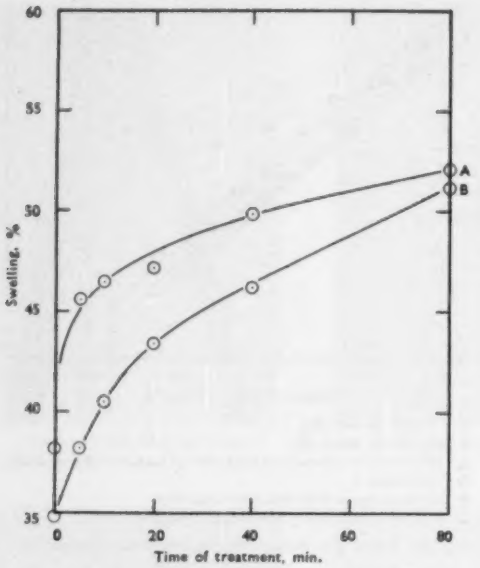

FIG. 17— Borax (10 g./litre), pH 9·25, at 100°C.

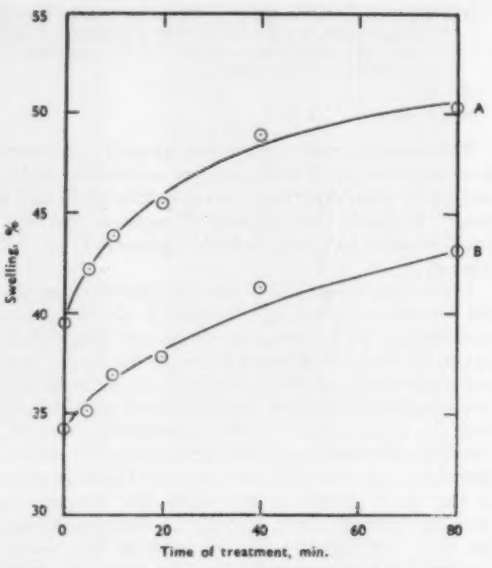

FIG. 19— Trisodium Phosphate (10 g./litre), pH 11·9, at 45°C.

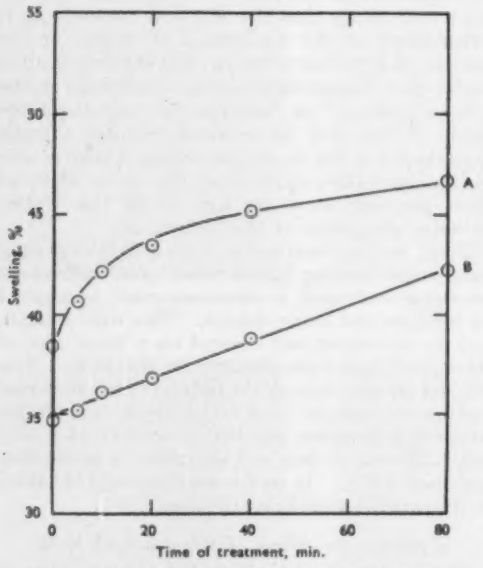

FIG. 18— Sodium Carbonate (10 g./litre), pH 11·4, at 60°C.

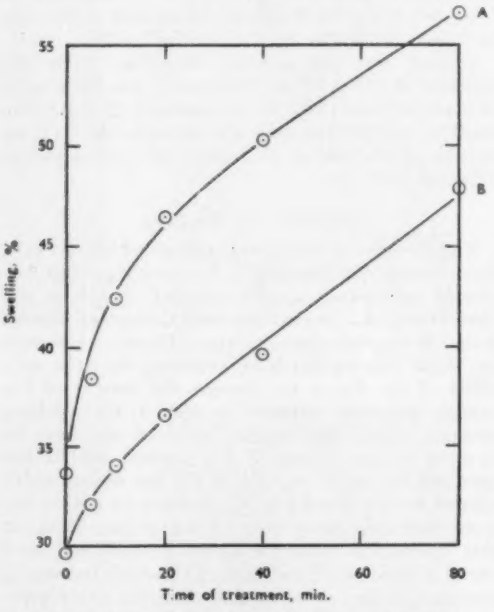

FIG. 20— Sodium Hydroxide (10 g./litre), pH 12·8, at 25°C.

A Undyed
B Afterchrome dyed with 5% Chrome Fast Cyanine 2BSS (C.I. Mordant Blue 5)

FIG. 17–20— Effect of Different Alkaline Treatments on Swelling of Neutralised Undyed and Dyed Wool

not be possible to detect them directly with this test. Nevertheless, such fibres should possess an increased resistance to severe swelling conditions and in particular to alkaline attack, and it has been found that chrome-dyed wool is in fact attacked by alkalis at a reduced rate compared with undyed wool.

Fig. 17–20 illustrate the rate of increase of the percentage swelling for undyed wool and wool dyed with Chrome Fast Cyanine 2BSS (C.I. Mordant Black 17) under different conditions for varying lengths of time. With higher pH values at lower temperatures, the difference between dyed and undyed wool becomes very marked, and it must be assumed that the resistance of the wool to alkaline attack under these conditions has been improved considerably by dyeing. At 80° and 100°C. the two curves tend to become identical, and this is

TABLE VIII

Dyeing (1%)	*Colour Index* No.	pH before	pH after	"Mean" pH	pH units from Isoelectric Point	Swelling (%)
Kiton Fast Red G	C.I. Acid Red 1	2·5	4·0	3·25	0·95	39·4
Benzyl Fast Red BG	C.I. Acid Red 99	7·3	6·4	6·95	2·65	40·3
Alizarine Blue Black B	C.I. Mordant Black 13	6·5	6·2	6·35	2·05	40·1
Chrome Fast Yellow O	C.I. Mordant Yellow 34	3·7	4·9	4·30	0·00	38·9
Neolan Red BRE	C.I. Acid Red 212	2·1	2·5	2·30	2·00	39·8
Cibalan Grey 2GL	C.I. Acid Black 62	7·4	6·9	7·15	2·85	40·6

probably the result of stripping of the dye, which is observed to take place.

Modifications under Normal Dyeing Conditions

The effect of various dyeing methods on the swelling of the wool is illustrated by the results in Table VIII. The usual additions were made to the dyebath.

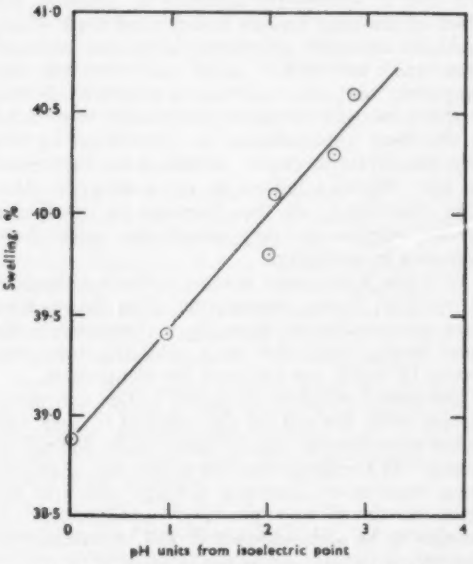

FIG. 21— Comparison of Different Dyeing Methods

The Alizarine Blue Black B was dyed afterchrome and the Chrome Fast Yellow O metachrome. It is immediately obvious that all these dyeings produce only a slight increase in swelling, one which could be safely ignored in practice. Interesting results are obtained if we compare the swelling figures with the pH conditions in use. Assuming the isoelectric point of the wool to be about 4·3, we find that the swelling varies directly with the deviation from this figure of the pH of the dyebath, irrespective of whether this be above or below 4·3. The average conditions of each bath have been calculated in a rough fashion by taking the mean of the pH values of the bath before and after dyeing. Fig. 21 shows that an approximately linear relationship exists between the swelling and the deviation of this "mean" from the isoelectric point. It is significant that these small changes in swelling are produced with equal facility on either side of the isoelectric point, and this suggests the possibility that we are measuring changes in the fibre which have been brought about by the rupture of the salt links between the molecules. It might be expected that breaking these links would have a permanent effect on the swelling properties of the fibre, in a similar manner to the more profound effects associated with disulphide bond rupture, since it need not follow that on re-forming the links the same groups recombine. The percentage swelling test results suggest that there has been a small amount of permanent molecular rearrangement before recombination.

(3) Tests for Main-chain Degradation

We turn now to a consideration of some tests for fibre damage which are capable of measuring the amount of hydrolysis of the main chain of the keratin protein. In commercial processes this is most often brought about by acids, but alkalis and oxidising agents also produce this effect. The main tests are the alkali solubility test, which is well established and has been critically examined by several workers [12–14], the urea–bisulphite solubility test, which is a comparatively recent technique, and the Krais–Viertel (K.M.V.) reaction, whose mechanism is obscure. The first two tests are very similar in that they entail treating the fibres with a solution which will rupture the disulphide cross-links. Once this is achieved, the amount of protein which is capable of being dissolved will then depend on the extent of hydrolysis of the main-chain peptide links. In this way the solubility figure in either alkali or a urea–bisulphite mixture is a measure of this type of damage. Alkali solubility figures, for instance, obtained by either the Harris [15] technique or the Ryberg [16] technique can be interpreted in this way.

ALKALI SOLUBILITY TEST

The alkali solubility test is completely useless for measuring alkali damage, as would be expected. Alkaline hydrolysis of the protein main chain is accompanied by rupture of the disulphide cross-links, and this leads to immediate swelling of the fibre, which facilitates access of damaging agent. The result is a rapid increase in the rate of reaction and the easy removal of the products of degradation. The alkali solubility figure, then, does not increase with alkali attack and may even decrease. With acid damage there is no reaction with cystine, the main reaction being main-chain hydrolysis. The products of degradation are not easily removed, since swelling is still restricted, and this means that very often little protein is actually dissolved during attack, but the fibre becomes sensitive to any future treatment, particularly alkaline treatment.

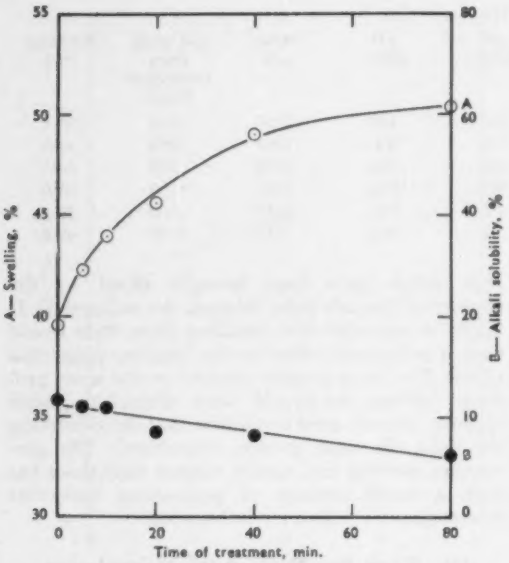

FIG. 22—Insensitivity of Alkali Solubility Test to Alkali Damage (neutralised wool treated with trisodium phosphate (10 g./litre), pH 11·9, at 45°C.)

Fig. 22 illustrates the complete insensitivity of the alkali solubility test to alkaline damage (comparative swelling results are included), and this may be compared with Fig. 14, which illustrates the insensitivity of the percentage swelling test to acid damage (comparative alkali solubility results are included). The two tests then form a useful complementary pair.

Oxidising agents such as chlorine and hydrogen peroxide have also been shown to cause main-chain degradation [15], and their effect can be readily measured by the alkali solubility test. In addition, however, they attack other groups, including possibly the disulphide cystine bond, but information is lacking as to the relative extent of these two reactions.

THE UREA–BISULPHITE SOLUBILITY TEST

Quite recently a new test for chemical damage to wool has been introduced which may eventually be found to be more useful than the alkali solubility test [17, 18]. This is the measurement of the solubility of the sample in a solution of 50% urea and 3% sodium bisulphite at 65°C. Some typical results have been given by Lees and Elsworth [17], and are reproduced below (Table IX).

There does not appear to be any reason why an increase in solubility in this test should not be interpreted in the same way as an increase in the alkali solubility figure, namely as evidence of main-chain hydrolysis. The most interesting results of this test are those obtained with alkali-damaged wools. As will be seen, very slight alkali damage greatly decreases the urea–bisulphite solubility. The test is sufficiently sensitive to measure the effect of scouring liquors under conditions which could be accepted as normal in actual practice. Lees and Elsworth [17] have put forward the suggestion that this decrease in solubility is due to the formation of stable lanthionine cross-links in the fibre which cannot be hydrolysed by the urea–bisulphite mixture. If this is so, they must be very effective indeed in preventing the fibre from dissolving, as the decrease in disulphide cystine sulphur is very small for quite large decreases in solubility.

TABLE IX [17]

Treatment	Urea–Bisulphite Solubility (%)	Cystine Sulphur (%)
Untreated	52·6	2·95
Boiled for 3 hr. at pH 2·2	72·4	2·91
Boiled for 3 hr. at pH 8·2	8·1	2·36
Untreated	47·3	2·67
30 min. in 0·1 N-Na_2CO_3 at 30°C.	33·7	2·68
30 min. in 0·1 N-Na_2CO_3 at 50°C.	25·2	2·59
30 min. in 0·1 N-Na_2CO_3 at 70°C.	2·5	2·37

In Table X are some results of this test applied to practical dyeing treatments. The figures here show more variation than those obtained on the same dyeings with the alkali solubility tests, the results of which are included for comparison.

The urea–bisulphite solubility varies extremely rapidly with the pH of the reagent [18], and this makes reproducible results rather more difficult to obtain. If anything, the test is also too sensitive, being capable of detecting damage which is too slight to be of any practical consequence. It remains to be seen whether it will be extensively adopted.

THE KRAIS–VIERTEL (K.M.V.) REAGENT

The Krais–Viertel reagent [19] consists of a solution of ammonia in caustic potash, and the test entails timing the appearance of the characteristic swellings which are seen in Fig. 22. The fibres illustrated were taken from a sample of damaged half hose. Acid damage decreases the time taken for these swellings to appear, and alkali damage is stated to increase the time. It is essential to observe all the usual precautions inseparable from microscopical tests such as proper sampling of the

TABLE X

Dyeing (1%)	*Colour Index* No.	Dyebath Final pH	Urea–Bisulphite Solubility (%)	Alkali Solubility (%)
Undyed	—	—	27·8	12·0
Orange II	C.I. Acid Orange 7	3·90	32·8	13·0
Benzyl Fast Scarlet G	—	6·65	22·9	13·3
Chrome Fast Orange G	C.I. Mordant Orange 6	6·20	19·7	12·0
Chrome Fast Yellow G	C.I. Mordant Yellow 16	4·85	23·4	11·9
Cibalan Grey BL	C.I. Acid Black 60	6·45	20·9	12·9

fibres, and the results are strictly comparable only with wools of the same quality. It is doubtful whether the test can be claimed to be quantitative.

Fig. 23 shows the swellings more clearly. They are far more substantial than those encountered in the Allwörden test and seem to emanate from the bulk of the fibre. They appear to consist of two phases. Fig. 24 shows fairly clearly what appear to be oily droplets inside the swellings. How these are produced and what is the mechanism of the reaction remain matters for speculation.

There is also a modification or development of this test which entails measuring the variations in length and ultimate supercontraction of a fibre immersed in the Krais-Viertel reagent rather than observing the characteristic swellings [11].

(4) Tests for Miscellaneous Types of Damage

MICROSCOPICAL TESTS

There are two types of damage which can usually be recognised microscopically. Fig. 25 illustrates severely scorched fibres. This type of damage is usually very easy to recognise, as the fibres turn yellow and begin to blister appreciably. In addition there is often a considerable amount of longitudinal shrinkage.

Fig. 26 is a photomicrograph of a micro-organism found on a sample of material suspected of having suffered damage by mildew. The certain recognition of such damage is more or less dependent on remains of the micro-organisms being found on the material, which is not always possible, since subsequent processing very rapidly removes these or damages them beyond recognition.

Fig. 27 illustrates a few fibres damaged by mildew and stained with Kiton Fast Red G. The damage is usually very severe, with complete destruction of some fibres, but is at the same time usually very localised.

The severity of the damage is shown more clearly by the fibre illustrated in Fig. 28, which has mildew hyphae adhering to it. It will be noticed that Kiton Fast Red G has stained the fibre heavily, but that the mildew is virtually unstained. By counter-staining with a basic dye it is possible to stain the damage on the fibre red as before and the mildew blue, as shown in Fig. 29.

* * *

The author wishes to record his thanks to the Directors of Ciba Clayton Ltd. for permission to prepare and submit this paper and to Mrs. M. Eason for assistance in the experimental work connected with the percentage swelling test.

DYEHOUSE
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(*MS. received 11th April 1958*)

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Fluorescent Brightening Agents

D. A. W. ADAMS

Meetings of the Leeds Junior Branch held at the University of Leeds on 4th March 1958, Mr. P. J. Smith in the chair; and of the Midlands Section held at the Midland Hotel, Derby, on 19th March 1958, Mr. A. W. Carpenter in the chair

The nature of fluorescent brightening agents, their historical development, properties, and uses are reviewed, and some details are given of their application in soap and detergents, in textile processing, and in the production of paper. Their chemical constitution is then discussed, and indications are given of the effect on their properties of changes in structure.

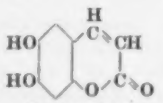
I— Introduction

Although of comparatively recent introduction, fluorescent brightening agents are now an established feature of detergent, textile, paper, and allied industries. Most chemists and technologists know of their uses and abuses, and the general public have come to expect their white textiles to be whiter and brighter than ever before. Many articles have been written on their application, and new patents are appearing almost weekly. The present paper aims at giving a brief summary of the history of these products, an idea of how and why they work, an indication of their commercial potential, a rather fuller account of their properties and methods of application, including some of the troubles likely to be met, and a survey of their chemistry.

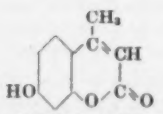
II— Historical Review and Commercial Potential

Fluorescence was first actively studied more than a hundred years ago by Stokes, who formulated certain fundamental laws governing the phenomenon. Since then, many organic chemicals and dyes have been shown to fluoresce under certain conditions: thus, organic-solvent solutions of many complex hydrocarbons, such as anthracene, are fluorescent; the alkaline aqueous solutions of many naphthylamine- and naphthol-sulphonic acids fluoresce violet, blue, or green; such intermediates as 4:4′-diaminostilbene-2:2′-disulphonic acid and dehydrothio-*p*-toluidine give strongly fluorescent solutions; and such fluorescent dyes as Fluorescein (C.I. Acid Yellow 73) and Eosin (C.I. Acid Red 87) are well known. Some of these compounds show their fluorescence only in ultraviolet radiation, but others exhibit the property also in daylight.

Some of these fluorescent properties have been put to commercial use: dehydrothio-*p*-toluidine and related compounds have been used as colourless marking inks in laundries; Fluorescein has been used for tracing the course of underground rivers; and some 25 years ago derivatives of 4:4′-diaminostilbene-2:2′-disulphonic acid were claimed as ultraviolet screening agents for Cellophane wrappings [1], and for producing fluorescent effects on textiles and paper, such as safety marks in banknotes [2]. The first mention of a whitening or brightening effect on textiles was made in 1929 by Krais [3], who noticed that aesculin, a glucoside of aesculetin (I) found in horse-chestnuts, imparted a whitening effect to white textiles immersed in its aqueous solutions. The effect was not fast to washing, however, and no use was made commercially of this observation. In 1939 Meyer patented the use of β-methylumbelliferone (II) for whitening textiles [4], and a little later its use for whitening soap itself was also claimed [5]. Shortly afterwards, derivatives of diaminostilbenedisulphonic acid, similar to those previously used as protective agents, were patented in Germany by the I.G. [6] and in this country by Lever Brothers [7] for use in soaps to give a whitening effect to textiles washed with them. The first commercial use in soaps and detergents of such compounds in this country was in 1942.



I— Aesculetin



II— β-Methylumbelliferone

The early products on the market were almost entirely for use only on cellulosic materials. Continued research, however, has led to a wide range of products, not only having improved properties on cellulose, but having special application to wool, man-made fibres, plastics, etc. Well over 100 British Patents have been granted, and some 30 or more manufacturers throughout the world are producing a range of between 150 and 200 different products. In 1955 the production in the U.S.A. was 1,375 tons — double the figure 3 years previously [8]. Today the production there is still higher — a sales value of $15 million has been quoted [9]— and the world production must be at least 2,500 tons.

III— Action and General Properties

1. MECHANISM

Organic substances which exhibit fluorescence normally have a system of conjugated double bonds in the molecule. Such molecules are capable of absorbing light and passing into an excited state of higher energy; these excited molecules then return to the ground state of lower energy with re-emission of light. As some energy is lost in this process, the re-emitted light is of longer wavelength (lower frequency) than the absorbed light.

Most such chemicals are activated only by light in a narrow waveband, usually in the ultraviolet region. Some dyes, however, absorb over a much wider wavelength range and give powerful emissions at fairly high wavelengths; these have found uses comparatively recently in the so called daylight-fluorescent printing inks for posters.

To act as brightening or whitening agents compounds must re-emit at the blue end of the spectrum, so that the emitted light is essentially complementary to the pale yellow colour normally shown by "white" cellulosic materials. The light absorbed, therefore, must be of still shorter wavelength— in practice the near ultraviolet.

As ordinary daylight has only a limited content of ultraviolet radiation, the blueing effect obtained is not very great when compared with the effect given by the fluorescent pigments. Much brighter effects are observed, of course, under ultraviolet radiation. In artificial light the effect is even less than in daylight, as the ultraviolet content of most artificial lighting is very small indeed.

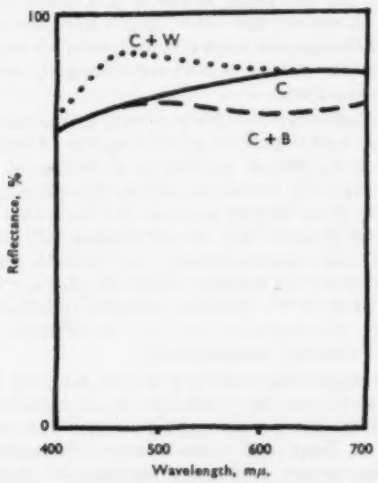


FIG. 1

The whitening effect given by fluorescent brightening agents, therefore, is an additive effect: the yellow colour is corrected by the addition of blue light, and the total light reflected from the material is greater than from untreated material. On the other hand, the old blue-bag worked by a subtractive process, the blue pigment absorbing yellow light equivalent to the blue light absorbed by the yellow colour of the untreated material; although the treated material looked whiter, in fact the total reflected light was lower (Fig. 1). Such agents were correctly designated "blueing" agents, whereas the fluorescent compounds are both blueing and brightening agents.

Fluorescent effects are from their nature largely surface effects, and in addition the fluorescence can be quenched at high concentrations by the inability of the molecules to pass to the excited state. In consequence the quantity of fluorescent brightening agent required to give a satisfactory effect is quite small, normally about 0·01–0·10% by weight on the weight of material. In fact, at high concentrations the fluorescent effect can be offset by the intrinsic colour of the brightener.

2. COLOUR OF THE FLUORESCENCE

Most fluorescent brightening agents have a dominant absorption maximum between 335 and 370 mμ., and a dominant emission wavelength some 100–130 mμ. above this; in general there is good correlation between the two figures. Fig. 2 shows the ultraviolet absorption curves for four

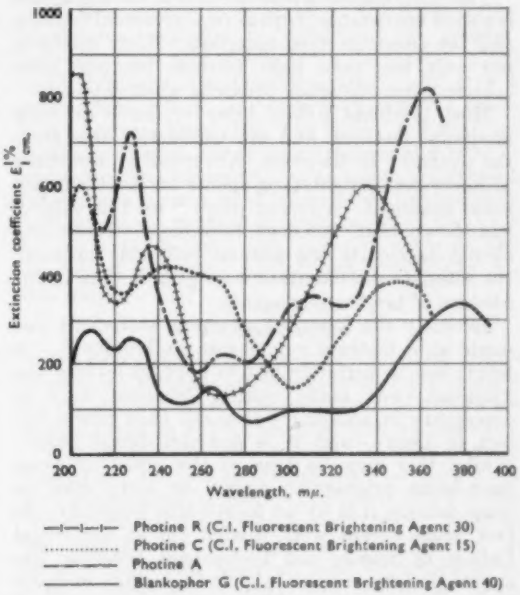


FIG. 2

fluorescent brightening agents: Photine R gives a typical reddish white, Photine C a bluish white with a slight red cast, Photine A a neutral white, and Blankophor G a pronounced greenish fluorescence. Generally speaking, compounds with the colours given by Photine C and Photine A are preferred in this country.

3. EFFECT ON DYED MATERIALS

The fact that fluorescent brightening agents add blueness to a fabric means, of course, that they must have some effect on coloured materials. The effect on deep colours is negligible, but quite marked effects can be produced on pastel colours, the effect being slightly different depending on whether the brightening agent has a reddish or a greenish-blue hue. In general, it may be said that pastel yellows will appear paler, pinks will appear more purple, blues will be brighter and stronger, and greens will be bluer and brighter. Fawns, greys, etc. will all be bluer.

In the early days of fluorescent brightening agents, before these effects were appreciated, some consternation was caused. Complaints were received that a cream vat dye on some curtaining

material had poor wash-fastness because the colour had become noticeably paler on washing; in point of fact, when washed with soap not containing a fluorescent brightening agent, the original colour returned as the less fast fluorescent brightening agent was removed. Complaints in laundries for similar reasons are still numerous, and in Germany it has been recommended that special detergents, without added fluorescent brightening agents, should be marketed for the washing of lingerie and similar materials usually dyed in pastel colours [10, 11].

4. LIGHT FASTNESS

The light fastness of fluorescent brightening agents is also of importance, both as regards actual fastness and the effect on dyed materials. Early products not only had poor light fastness but also gave coloured decomposition products when exposed.

Most products today, however, have at least moderate fastness, and are completely free from the tendency to discolour. Nevertheless, the effect of fluorescent brightening agents on wool calls for some comment. A recent paper [12] on this subject has shown that, although fluorescent brightening agents accelerate the normal yellowing of wool, the ultimate discoloration is no greater than in the absence of brightening agents.

Recently the following sweeping statement was made at a fastness symposium in London [13]: "A fabric can be perfectly fast to light on leaving the dyehouse, but many optical bleaches used in detergents in washing will make that fabric not fast to light — and it is not the dyers' fault". Whilst this may be true of the effect of some fluorescent brightening agents on some dyes on some fabrics, it is by no means true generally. In fact, some recent work carried out at the Royal College of Science and Technology, Glasgow, has shown that fluorescent brightening agents in many cases act as ultraviolet screening agents, and actually increase the fastness to light of dyes (*personal communication*).

5. TOXICITY

The possible toxicity of fluorescent brightening agents has been considered and recently the British Pharmaceutical Council has banned the use of brightening agents on materials to be used for bandages, surgical dressings, etc. There appear to be no grounds for this action or for supposing that fluorescent brightening agents are toxic; on the contrary, several publications in Germany [14, 15] state that no dermatitic or oestrogenic effects can be observed even at concentrations 100 times those normally used. Further, we have had no single case of toxic symptoms in any workman handling tonnage quantities of these chemicals over several years, and there have been no complaints arising from their extensive use in domestic washing powders.

IV— Properties of Brightening Agents for Specific Purposes

1. DETERGENTS AND SOAPS

By far the biggest usage of fluorescent brightening agents is still for incorporation in soaps and detergents, the rate of usage being between 0·05% and 0·1% depending on the type of whitener used and the country concerned, the incorporation rate being generally somewhat higher in America than in this country.

Most whites in the weekly wash are cottons, and fluorescent brightening agents for soaps and detergents should therefore primarily have good affinity for cellulose. They can be regarded as colourless direct cotton dyes, and in general have very similar properties. Just as such dyes are not very suitable for application to other fibres, fluorescent brightening agents chosen as pre-eminently suitable for cellulosic materials cannot be expected to give very good results on other fibres. A few, however, do have reasonable affinity for both cotton and nylon, but in general these are more complicated to manufacture and therefore are more expensive. Alternatively, a mixture of two fluorescent brightening agents may be employed, one chosen for its affinity for cellulose, and the other for its affinity for nylon, wool, etc. As affinity for cellulosic fibres is the main consideration, however, the other important features required in fluorescent brightening agents for soaps and detergents will be considered primarily with regard to this class.

To be satisfactory for this purpose, a fluorescent brightening agent must— (*a*) be capable of being dissolved or dispersed uniformly in the soap or detergent mix, (*b*) be stable at the temperatures used in the spray-drying process, (*c*) be stable to other agents present such as perborates, (*d*) have reasonably high substantivity, so that a good effect is obtained on a single wash, (*e*) give a good build-up over 5–10 washes without producing undesirable discoloration, and (*f*) be effective at all normal washing temperatures.

There is a growing tendency in this country for housewives to use hypochlorite as a bleaching agent, and in some countries this practice is nearly universal. Many of the early fluorescent brightening agents had poor fastness to hypochlorite, and most of the diaminostilbenedisulphonic acid type still on the market are largely destroyed by hypochlorite when they are in solution. Once on the fibre, however, they show a reasonable fastness. Some new types to be discussed later show complete resistance to hypochlorite both in solution and on the fibre.

In some cases whitening of the soap or detergent itself may be important: some fluorescent brightening agents have the property of both whitening materials washed and whitening the soap, but in other cases it may be necessary to add a second product specially for its effect on the soap.

2. TEXTILES

(*a*) *Cellulosic Materials*

Many white cotton goods are now treated with a whitening agent during bleaching and/or finishing. They may be applied as part of the bleaching process or as an aftertreatment either by exhaust methods, as in dyeing with direct cotton dyes, or by padding. Essential features are reasonably good

solubility and in general rather lower substantivity than required for use in soaps or detergents. Too high a substantivity can lead to uneven application, particularly in package machine treatment of yarn or in winch or jig application on pieces.

Additional complications may arise where the material is subjected to certain finishing operations. In particular, crease-resistant finishes and non-iron drip-dry finishes call for comment. In these cases the fluorescent brightening agent may be added either prior to the resin treatment or preferably, from a labour-saving point of view, along with the finish. Many fluorescent brightening agents are not completely stable to the acid catalysts employed, and the majority are not compatible with any cationic softening agents used. By careful selection of fluorescent brightening agent, catalyst, and softening agent, however, very good results can be obtained. Viscose rayon can be treated similarly to cotton, and in addition it is possible to add certain fluorescent brightening agents to the viscose before spinning.

(*b*) *Wool*

Natural wool is cream in colour, and there is not a very big demand for a perfect white. Where a white is desired, too, there is a preference for a milky or greenish white rather than the mauve-bluish white generally preferred for cotton.

As already stated, it is not easy to obtain fluorescent brightening agents giving a reasonable effect on wool from detergents. Some products are available, however, which resemble acid wool dyes chemically and can be applied from a weak acid bath. Fastness to light, however, is usually inferior to the general level of fastness on cellulosic materials.

(*c*) *Synthetic Fibres*

Only a few of the fluorescent brightening agents suitable for cotton have affinity for nylon. In general, either the special types suitable for wool or special dispersed or cationic types are employed. Many fluorescent brightening agents tend to give a more pronounced reddish hue on nylon than they do on other fabrics, and in general the greener wool types are therefore preferred.

Other synthetic fibres, such as Terylene and Acrilan, are even more difficult than nylon to whiten satisfactorily, and special types, mainly dispersed insoluble compounds, have had to be developed. These will be referred to later when dealing with chemical constitution.

3. PAPER

Many of the better-class papers are now treated with fluorescent brightening agents to improve their whiteness. The paper stock must be of a reasonable degree of whiteness before application, and the cheap newspaper type of stock is not suitable for treatment. The brightening agents may be applied in the beater, subsequent to the bleaching stage, by dipping the finished web, or along with any suitable surface coating. The types employed are similar to those used for soaps or cotton textile treatments, but some special properties are necessary for some applications. Thus, in beater application, when size and alum are employed, the fluorescent brightening agent must not be affected by these substances, and must be effective at pH values down to 4·5. In general, the brightening agents should be added to the beater before addition of the size or alum to minimise the effects of these latter agents, but even then some fluorescent whitening agents will be unsuitable if the back-water is strongly acid.

4. PLASTICS

Fluorescent brightening agents suitable for plastics are now available. They must be free from groups imparting water-solubility and must be soluble and compatible with the plasticiser, etc. used; they must also be stable to the temperature conditions employed in moulding. In general, because of the true solubility of the agents in the finished plastic, the quantity required to give a pronounced effect is extremely small, much smaller even than the quantities required on textiles or paper. Many colourless plastics tend to discolour on exposure, and some fluorescent brightening agents tend to improve the stability to light of the plastics treated; however, they are not so suitable from this point of view as the ultraviolet screening agents sold specifically for this purpose.

V—Evaluation

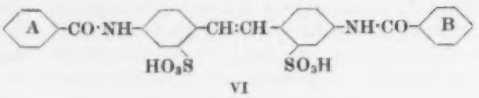
The evaluation of fluorescent brightening agents follows the methods already known and developed for the evaluation of dyes in general, but there are some difficulties not experienced with normal dyes.

Standardisation of regular batches of a commercial product as produced can be carried out by measuring the extinction coefficient at a suitable wavelength of the absorption spectrum. That at the dominant wavelength around 350 mμ. is usually used. This, however, must be backed up by actual application tests, the patterns being examined both visually in daylight and under ultraviolet irradiation, and using an appropriate instrument in which the visible light emitted from the pattern activated by ultraviolet radiation impinges on a selenium cell and gives a reading on a galvanometer. These methods taken together work reasonably well in the hands of a skilled operator.

According to Allen [16], by visual examination in daylight it is impossible to distinguish less than a 10% difference in strength; at suitable concentrations, however, we believe the figure to be nearer 5%. The same author quotes distinguishable strength differences of 5% by visual examination under ultraviolet irradiation and 1·5% by use of a fluorimeter.

Comparison of two different fluorescent brightening agents, however, presents more difficulty. Comparisons of the ultraviolet absorption curves give no indication of comparative strength, and application tests must be carried out under a variety of conditions depending on the use—application in presence of detergents at different temperatures; application to various textile materials, at different liquor ratios in presence or absence of salt, by exhaust methods,

and by padding; application to paper pulp under different conditions; etc. Even then there are considerable difficulties in assessing the results because of the different shades of white obtained. One observer will prefer a reddish white, another a bluish or neutral white, and a third a greenish white, making a correct assessment of products giving a different shade virtually impossible. In addition, the sensitivity of fluorimeters varies at different wavelengths, and erroneous results can be obtained. Many papers have been published on this subject, and some of the more important are given in the list of references [16–22].



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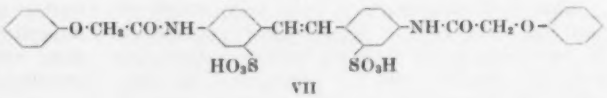

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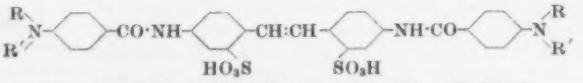
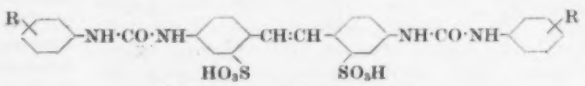


VIII— R = H, R′ = $CH_2·SO_3Na$, etc.; or R and R′ = $CH_2·CH_2OH$

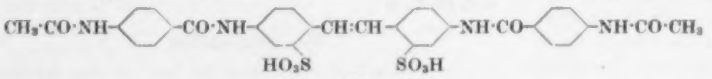


IX— R = *o*- or *p*-O·C_2H_5 or *m*-CF_3

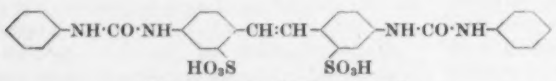
VI— Chemical Constitution

1. STILBENE DERIVATIVES

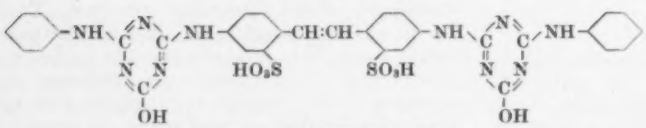
Most of the earlier fluorescent whitening agents were based on the stilbene molecule, particularly on 4:4′-diaminostilbene-2:2′-disulphonic acid, and by far the largest weight of products manufactured today are still of this class. The formulae of three of the early examples (III–V) are given below.



III



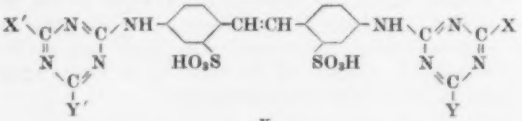
IV— Blankophor R (IG) (C.I. 40600)



V— Blankophor B (IG) (C.I. 40620)

III is a typical acylated derivative of diaminostilbenedisulphonic acid as claimed in Lever Brothers' early patent [7]. IV is a ureido derivative of diaminostilbenedisulphonic acid and is in fact Blankophor R, one of the first two fluorescent whitening agents put out by the former I.G. during the Second World War [23]. Its main characteristic is a very reddish-blue fluorescence, and it is still used today where this particular colour is desired. Its fastness to light and to hypochlorite is relatively poor. V is Blankophor B, another early product put out by the I.G.[23]. It gave a bluer fluorescence than Blankophor R but still slightly on the red side. All three types have been the subject of research, and many patents have been taken out covering modifications of these structures. Some of the acylated derivatives of 4:4′-diaminostilbene-2:2′-disulphonic acid are shown in formulae VI–VIII. In VI the two benzoyl groups, A and B, can be substituted, preferably in the *ortho* or *para* positions, by methoxy [24–27], ethoxy [25], hydroxyethoxy [28], halogenoalkoxy [29], or alkenyloxy groups [30]. Alternatively, there may be one of these groups and one alkyl group present [28, 31, 32], or a 3:4-methylenedioxy group [33, 34]. In still further variations, the benzoyl group is replaced by a 3-methoxy-2-naphthoyl group [35] or its tetrahydro derivative [36]. Products of this type are relatively expensive, have a lower substantivity than the triazine type (discussed below), but have moderate to good resistance to hypochlorite. A further variation is shown in VII, the phenoxyacetyl derivatives being claimed to have superior affinity for wool [37]. VIII shows a further variation in which an attempt is made to increase the solubility of this class of compound [38].

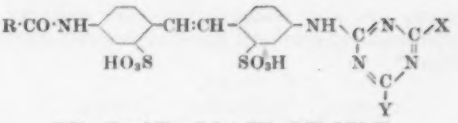
IX shows variations in the ureido type. The compounds in which the group R is *o*- or *p*-ethoxy have been claimed as having superior properties to the unsubstituted product and giving less red shades [39]. Compounds in which R is a *m*-trifluoromethyl group have also been proposed [40].



X

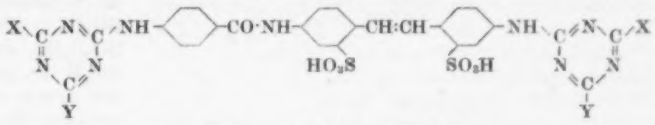
X shows the basic common structure of the triazine class. A very high proportion of the fluorescent brightening agents on the market are of this general structure, and many patents have been taken out covering specific groups on the triazine ring conferring specific properties. The most common types are the symmetrical types in which X and X′ are the same, and Y and Y′ are the same. These are easy to prepare by stepwise replacement of the chlorine atoms of cyanuric chloride. Those in which X and X′ or Y and Y′ are different can in general be prepared only in a

roundabout manner starting from nitroaminostilbenedisulphonic acid, condensing this with cyanuric chloride, replacing stepwise the two chlorine atoms, and then reducing the nitro group and doing the same on the other half of the molecule. Obviously, these unsymmetrical ones are considerably more expensive to prepare, and in general they have very little advantage in properties. In the original Blankophor B, X and X′ were anilino groups, and Y and Y′ hydroxy. Many more recent products have all four groups as substitited amino groups [41–58]: thus X and X′ may be anilino, toluidino, or anisidino residues, or residues of metanilic acid; Y and Y′ may be similar or may be aliphatic amines such as methylamino, dimethylamino, hydroxyethylamino, bishydroxyethylamino, etc. In other cases X and X′ are again substituted amino groups, but Y and Y′ are either phenoxy or thiol groups, or in some cases may be unchanged chlorine [59–64]. Whilst variation in these groups has some effect on the fluorescence, both intensity and colour, the main effect is in altering the other physical properties— solubility, substantivity, sensitivity to acids, and so on. In general, all products of this class are unstable to hypochlorite in solution, but some show reasonable stability once they have been applied to the fibre. XI and XII are two further variations of this type in which two stilbene residues occur. One of these has three triazine rings [65], the other one triazine and two acyl groups [66].

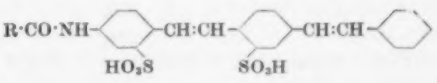


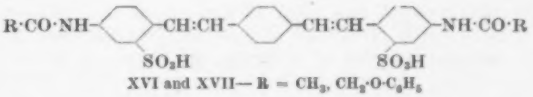
XIV— X and Y = Subst. NH_2, O·R′, S·R′, Cl; R = C_6H_4·O·Alk, CH_2·O·C_6H_5, etc.

again be alkoxybenzoyl, phenoxyacetyl, etc.[66, 68–70]. This mixed type is claimed to give rather less reddish fluorescence than the bistriazine type and also to have better affinity for wool. Another variation giving greener fluorescence is XV [71].



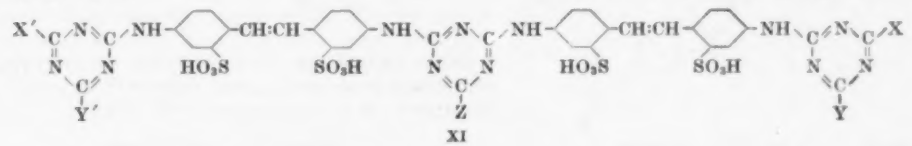
XV— X and Y = Cl, OH, subst. NH_2, etc.



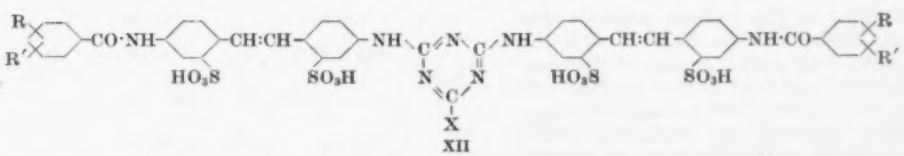


XVI and XVII— R = CH_3, CH_2·O·C_6H_5

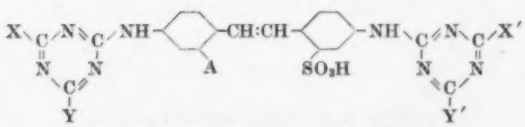
In an attempt to improve the hypochlorite stability of compounds of these types, 4:4′-diaminostilbene-2:2′-disulphonic acid has been replaced as starting material by 4:4′-diamino-5:5′-dichlorostilbene-2:2′-disulphonic acid [72]. The alkoxybenzoyl derivatives of this are stated to



XI



XII

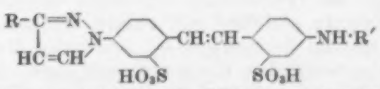


XIII— A = H, CH_3, O·CH_3, Cl, SO_3·NH_2, etc.

have much higher resistance to hypochlorite than the unchlorinated compounds. Two further variations of the stilbene type (XVI and XVII) contain two ethylene linkages instead of one [73, 74]; this results in a marked shift to the green.

Compounds of the bistriazine class in which one of the sulpho groups in diaminostilbenedisulphonic acid is replaced by another group such as halogen, alkyl, alkoxy, sulphamoyl, etc. (XIII) have recently been claimed [67]; they are stated to give more neutral whites than the symmetrical disulphonic acids.

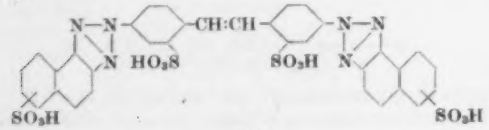
XIV shows a mixed acyltriazine derivative. The X and Y groups can again be substituted amino groups or substituted hydroxy or thiol groups, or one group may be chlorine; the acyl group may



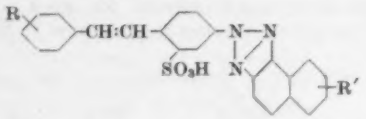
XVIII— R = Alk (CH_3); R′ = CO·C_6H_5, a triazine ring, etc.

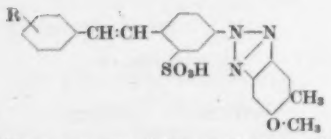
A still further variant of the stilbene type is that in which one of the amino groups of diaminostilbenedisulphonic acid is substituted normally by either an acyl or a triazinyl substituent, and the other forms part of a pyrazoline ring (XVIII) [75]. Triazine or acyl derivatives in which both sulpho groups are replaced by substituted sulphamoyl

groups are also claimed; they are suitable for application to synthetic fibres at the melt-spinning stage [76].

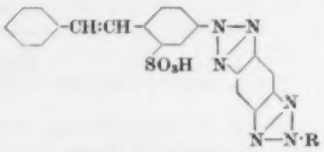


XIX

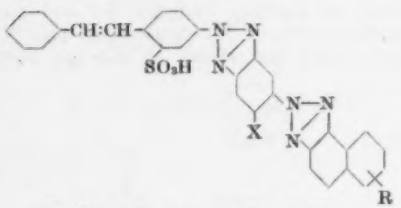




XX and XXI— R = H, CH_3, O·CH_3, Cl, SO_3H, etc.; R′ = SO_3H, H

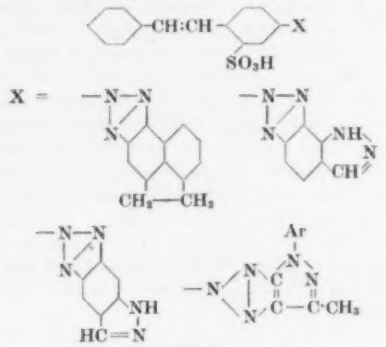


XXII— R = C_6H_5 or $C_{10}H_7$



XXIII— X = H, Cl, etc.; R = H, SO_3H

A new grouping in the stilbene molecule was introduced by Farbenfabriken Bayer [77] with the compound XIX. The amino groups of diaminostilbenedisulphonic acid have been converted into triazole rings by coupling with a naphthylaminesulphonic acid followed by oxidation. Such compounds have an extremely greenish fluorescence, and their main uses are as shading components for compounds having a red fluorescence. Such triazoles, however, have very marked resistance to hypochlorite: in fact, the oxidation of the aminoazo dye to the triazole can be carried out by boiling with hypochlorite. Attempts to retain this hypochlorite stability but obtain compounds of more neutral fluorescence by decreasing the conjugation resulted in the compounds shown in XX and XXI and patented by Geigy Ltd. The first of these (XX) is made in the same way as the bistriazole XIX but starting from 4-aminostilbene-2-sulphonic acid [78]. The elimination of the second triazole ring has resulted in a shift back from the green to the blue. Many of the compounds of this type also have reasonably good affinity for nylon. The second example (XXI) is prepared similarly using a benzene derivative capable of coupling *ortho* to the amino group instead of the naphthylamine derivative [79]. Two further extensions are XXII and XXIII, in the first of which aminostilbenesulphonic acid is coupled once to *m*-phenylenediamine and oxidised to the triazole [80]; the aniline or naphthylamine derivative is then coupled to the resulting compound and the aminoazo dye again oxidised to a triazole. In the second example (XXIII) [81] a *m*-phenylenediamine derivative is again used, but in this case the remaining amino group is diazotised and coupled to a naphthylamine derivative, and again oxidised to a triazole. Still other variants replace the SO_3H by Cl, CN, COOH, etc. or by SO_2·NRR′, $SO_2C_6H_5$, etc. When solubilising groups such as SO_3H are present in the naphthylamine portion, the agents are suitable for cellulosic materials or artificial fibres [82], but when solubilising groups are completely absent the compounds are suitable for brightening plastics [83].

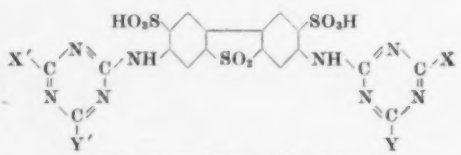


XXIV

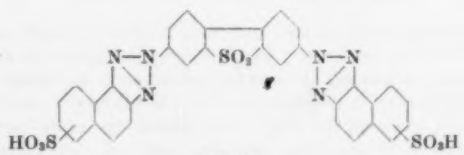
Other variants are those in which the coupling component is an aminoacenaphthene [84], an aminoindazole [85], or an aminopyrazole [86] (XXIV).

2. BENZIDINE DERIVATIVES

XXV— R = O·Alk



XXVI— X, X′, Y, Y′ = Subst. NH_2, etc.



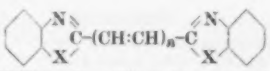
XXVII

Some early patents claimed the use of a benzidinedisulphonic acid as a starting point for fluorescent whitening agents in place of diaminostilbenedisulphonic acid. The resulting products.

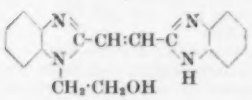
however, had markedly inferior fluorescence. More recently benzidine sulphone has been proposed as a starting product. The first example (XXV) shows an acylated derivative of a disulphonic acid of benzidine sulphone in which, again, alkoxybenzoyl groups are preferred [87, 88]. Such compounds are weak compared with the stilbene derivatives, and give a greenish fluorescence, but have good stability to hypochlorite. The second example (XXVI) is a triazinyl compound, and the same remarks apply to the various groups X, X′, Y, Y′ as in the case of the stilbene derivatives [89]. The third example (XXVII) utilises the triazole ring again, and this compound is claimed to give a good neutral fluorescence of high resistance to hypochlorite [90].

3. BENZOTHIAZOLE, BENZOXAZOLE, AND BENZIMINAZOLE DERIVATIVES

One of the earliest benzothiazole derivatives known to have fluorescent properties was dehydrothio-*p*-toluidinesulphonic acid. The intrinsic colour of this compound was too intense a yellow, however, to make it of any use as a fluorescent brightening agent. Of recent years a large number of products have been patented in which the benzothiazole, benzoxazole, or benziminazole structure occurs. One of the earliest types is XXVIII, where the ethylene grouping may be either absent or present [91–94]; a specific compound of this type is XXIX. Such compounds have reasonable affinity for nylon and also good resistance to hypochlorite. The alkyl groups have also been replaced by alkenyl groups such as allyl [95]. Quaternary derivatives, having improved affinity for nylon, cellulose acetate, Terylene, etc., have also been suggested [96].



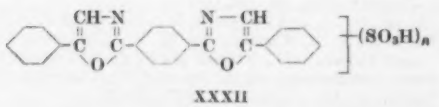
XXVIII— X = NH, O, S; *n* = 0 or 1



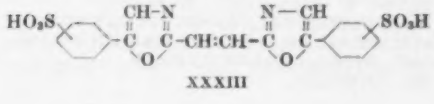
XXIX

XXX— X = Direct link, CH:CH, etc.; Y = O or S; R = Aryl

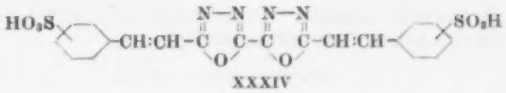
XXXI



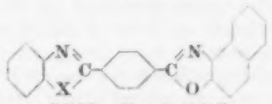
XXXII



XXXIII

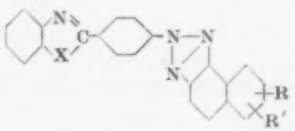


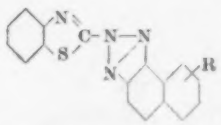
XXXIV

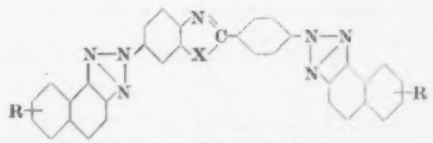


XXXV— X = O, S, NH

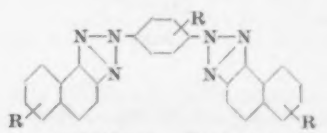
A variation is shown in XXX, this compound being based partly on the benzidine and partly on a benzoxazole structure. The specific structure in XXXI is claimed to give a reddish fluorescence on cotton and to have fair stability to hypochlorite [97]. XXXII and XXXIII are two compounds having oxazole rather than benzoxazole groups [98, 99]. The oxazole group provides a method of extending the conjugation of the benzene rings and of the ethylene grouping. A further variation of the same type is shown in XXXIV, in which oxadiazole rings are present instead of the oxazole ring [100]. This is claimed to have affinity for cotton, wool, and nylon, and to be fast to light and hypochlorite. A still further variation is shown in XXXV, in which a naphthoxazole ring is present together with either a benzoxazole, benzothiazole, or benziminazole ring [101].







XXXVI–XXXVIII— X = O, S, or NH; R = H, SO_3H, or COOH; R′ = H, OH, $SO_2{\cdot}NH_2$, etc.



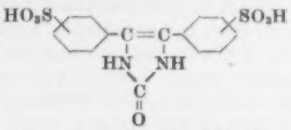
XXXIX— R = H or SO_3H

This type of structure has also been combined with the triazole structure. A large number of patents [102–108] covering compounds of this type have been taken out and three typical examples are shown (XXXVI–XXXVIII). Again, X can be O, S, or NH, and the naphthalene ring can contain sulpho or carboxyl groups or, in addition, hydroxy or sulphamoyl groups. A further triazole type of compound is XXXIX, this being derived from *p*-phenylenediamine and two naphthylamine derivatives capable of coupling

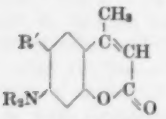
in the *ortho* position [169]; this would be expected to have a lower fluorescent activity.

4. MISCELLANEOUS TYPES

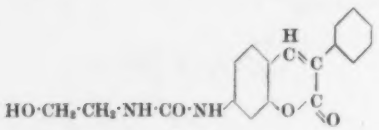
Most of the types described above have basic structures related to those of direct cotton dyes. There are a number of other types, which have been proposed specifically for use on protein fibres, wool, nylon, etc. In general, their effect on cotton is poor. The first compound specifically claimed for use on wool was Blankophor WT (XL) [23]. It is applied to wool from an acid bath, and is completely ineffective from soap or detergent solutions.



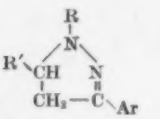
XL— Blankophor WT (C.I. 40640)



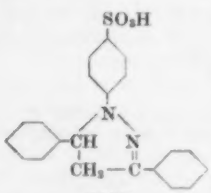
XLI— R = H, CH_3, or C_2H_5; R′ = H or CH_3



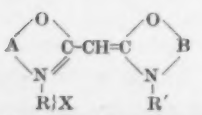
XLII



XLIII— R = C_6H_5, etc.; R′ = H, Alk, Ar, etc.

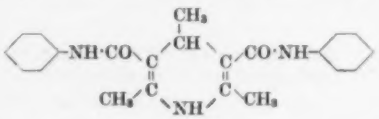


XLIV

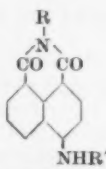


XLV— A and B are either benzene or naphthalene rings; R and R′ = Alk, etc.; X = Acid residue

Another class of compound specifically for use on wool and nylon is based on the old β-methylumbelliferone structure (II) but contains substituted amino groups (XLI) [110, 111] instead of hydroxy. These products can be applied either from dispersions in a soap or detergent bath or as their salts under acid conditions. A further variation is XLII [112], in which a ureido group is present instead of a substituted amino group. Another class specifically designed for wool, but having also affinity for nylon, is the arylpyrazoline type shown in XLIII and XLIV [113–115]. Another type for wool and synthetic fibres such as Acrilan has a methin structure related to the structure found in photographic sensitisers. They are of general formula XLV, in which A and B can be either benzene or naphthalene rings [116–118]. The products with two benzene rings have in general a reddish-blue fluorescence, those with one benzene and one naphthalene a neutral fluorescence, and those with two naphthalene rings a greenish fluorescence. A further type for artificial fibres is that based on collidine (XLVI) [119].



XLVI



XLVII— R = C_4H_9, C_6H_5, etc.; R′ = CO·CH_3, CO·NH·C_6H_5, etc.

Finally, the aminonaphthalimides (XLVII) have been shown to have fluorescent properties suitable for application to plastics [120].

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PUBLICATIONS SPONSORED BY THE SOCIETY'S FASTNESS TESTS CO-ORDINATING COMMITTEE— XXVI

The Measurement of Colour Fastness to Steam Pleating

PLEATING FASTNESS SUBCOMMITTEE

The Pleating Fastness Subcommittee has studied the problem of testing the fastness of coloured textiles to steam pleating processes and has devised a suitable test method. There is good correlation between the results of the test and those produced in practical pleating. A simple piece of apparatus has been designed to maintain close and even contact between the test pattern and adjacent undyed fabrics. Any staining of these adjacent fabrics takes place uniformly, and reliable assessment of the degree of staining can be made. A range of steaming conditions has been chosen to cover all fibres. The test has been adopted as an I.S.O. Tentative Test, the only modification being the addition of two extra steaming conditions.

Many textile fabrics composed of wool, cellulose triacetate, polyester, polyamide, or acrylic fibres, blends of synthetic fibres with natural fibres, or resin-treated cellulosic fibres are pleated by treatment with steam under pressure to produce an effect with greater or lesser permanency, depending upon the severity of the treatment and the particular fabric being processed.

The effect of these treatments on the colour of the dyed fabric will depend upon the fastness of the dyeing and the severity of the treatment in respect of time, temperature, moisture content of the fabric, and fabric construction. It is desirable that the pleating conditions used should be varied in respect only of time and temperature in order to achieve the best result on the particular fabric being processed, but in practice there can be a considerable variation in treatment, particularly in respect of the effect on colour fastness, owing to an uncontrolled variation in moisture, resulting from the use of equipment which does not allow for standardisation of conditions. However, steam pleating equipment is readily available, and in wide use, which allows for full control of the conditions, which leads to the production of reproducible results.

The Pleating Fastness Subcommittee of the Society of Dyers and Colourists has considered the

tests proposed to assess the colour fastness to steam pleating. The test tentatively proposed by the AATCC[1] entailed steaming the pattern at 5 lb. per sq. in. (0·35 kg./sq.cm.) steam pressure (108°c.) for 15 min. No provision was made for determining staining of adjacent fibres. This test was thought to be unsuitable for the following reasons—

(*a*) It would not be sufficiently severe for many fabrics
(*b*) It did not cover the staining of adjacent fibres
(*c*) The test could be used only for dyed fabrics
(*d*) The method of assessment did not correspond to that now considered desirable.

A different test is suggested by the Commission d'Étude des Essais de Solidité des Teintures of the Institut Textile de France (April 1958)[2]. Two steaming conditions, at 107 ± 2°c. and 130 ± 3°c., are given, and provision is made in the proposed test for assessing the staining of adjacent fibres and also for testing the fastness of slubbing, loose fibre, and yarn, in addition to piece goods. It is thought that this test approaches much more closely the conditions required, but would not form a completely satisfactory basis for a standard test for the following reasons—

(1) In order to obtain reproducible staining of adjacent fibres it is necessary to maintain close and even contact between the dyed specimen and the adjacent white fabrics. It has been shown that this is not achieved by sewing the fabrics together. A reproducible method of achieving this object will be described later.

(2) It is unlikely that the two steaming conditions would give a useful description of the colour fastness of the wide range of dyed fibres now available.

(3) Wetting of the test patterns during steaming greatly increases the severity of the test. No details of the methods adopted to obtain reproducible conditions for this important factor are given. Experience has shown that, without those details, poor reproducibility is achieved.

Factors affecting the Colour Fastness of Dyed Fabrics during Steam Pleating

1. EFFECT OF TEMPERATURE

In considering the effect of pleating temperature upon the colour fastness of dyed materials, it must clearly be recognised that two broad classes of dyes are involved, namely water-soluble and water-insoluble dyes. In the dry state water-soluble dyes do not sublime and, for this reason, there is no danger of staining of adjacent white fibres. Tests have shown[3] that, provided that the material being pleated does not contain excessive quantities of water, which might form in effect a localised dyebath, then no migration of water-soluble dye results. With both water-soluble and water-insoluble dyes, however, there is always the possibility of a change in colour of the dyed material resulting from lack of stability of the dye under the conditions of test. With the water-insoluble dyes there is also the possibility of staining of adjacent fibres in the complete absence of water, but tests have shown that, for example, unless the temperature of steam pleating is appreciably above 120°c. for times of treatment of 5 min.[4], no significant transfer of the slowly diffusing fast type of dye results. Significant transfer of the fast type of dye through the vapour phase requires temperatures greater than 120°c., unless the times of treatment are prolonged. Nevertheless, there is evidence to show, as detailed in Table I, that under identical conditions, staining of adjacent fibre occurs with disperse dyes applied to, for example, Terylene, but no staining results with direct dyes applied to viscose rayon. Table I also gives a comparison of the staining obtained using dry heat and steam under the preferred conditions. As the transfer of disperse dye does not take place through the vapour phase, it follows that, in the case of the disperse dye, transfer of dye must have taken place through the aqueous phase. However, the direct dyes used, applied to viscose rayon, possess lower fastness to wet treatments than disperse dyes applied to Terylene, and for this reason the large difference in result is probably due to the greater water imbibition of the viscose rayon than of Terylene, which results in the free water, produced by the cooling effect of the heat capacity of the fabric under test, etc., being absorbed in the case of viscose rayon, and not in the case of hydrophobic fibres such as Terylene. It follows from the above reasoning that a disperse dye, applied e.g. to Terylene, may have higher fastness to pleating when the Terylene its blended with a hydrophilic fibre such as wool or viscose rayon than when the dyed Terylene is present as a 100% fabric.

TABLE I

Dyeing	Dry heat at 125°c. for 15 min.		Steam under Preferred Conditions at 15 lb./sq.in. for 15 min. (1·06 kg./sq.cm.) (121°c.)	
	Staining of Adjacent Fibres			
(1) 1·0% Dispersol Fast Orange G 300 (C.I. Disperse Orange 3) on cellulose triacetate	5 (triacetate)	5 (wool)	2 (triacetate)	1 (wool)
(2) Red on cellulose triacetate	4–5 (triacetate)	4–5 (wool)	1 (triacetate)	1 (wool)
(3) Black on Terylene	3 (Terylene)	3–4 (wool)	1 (Terylene)	1 (wool)
(4) Dark brown on Terylene	3–4 (Terylene)	3–4 (wool)	1 (Terylene)	1 (wool)
(5) 0·5% Chlorazol Fast Scarlet 4BS (C.I. Direct Red 23) on viscose rayon	—	—	5 (viscose rayon)	5 (wool)
(6) 0·85% Durazol Brilliant Blue B8 on viscose rayon	—	—	5 (viscose rayon)	5 (wool)

2. EFFECT OF MOISTURE

In testing fastness to steam pleating, the effective control of moisture is, perhaps, the most important single variable. Some condensation of water on the pattern is essential if the test is to reproduce the best commercial pleating conditions. The reason for this requirement is the condensation of moisture on the fabric and on the pleating formers due to the heat capacity of the materials. On the other hand, an excessive condensation of water on the specimen, which results in the patterns being wet, is far too severe, and very few dyes will stand up to these conditions. This aspect of moisture control has already been discussed under §1 and will be further discussed when dealing with details of the proposed pleating test.

3. EFFECT OF TIME OF PLEATING

This variable is readily controlled, and is determined only by the need to reproduce conditions used by commercial pleaters.

4. EFFECT OF CONTACT PRESSURE BETWEEN TEST PATTERN AND ADJACENT WHITE MATERIAL

For reasons which will be discussed later, the degree of dye staining on the adjacent white materials is of the greatest importance to the loose-fibre, slubbing, or yarn dyer. It is, therefore, desirable to know the effect of pressure of contact between the specimen and the adjacent white materials on the severity of the test. This aspect has been investigated, and it has been shown that, providing that close contact is maintained between the test pattern and the adjacent white fabrics, a very large variation in pressure does not produce any change in the degree of staining. The above result is not obtained if the heat capacity of specimen, adjacent materials, or materials in contact (such as a holder) is not kept constant. In order that the assessment of the degree of staining may be reliable, it is very desirable that a uniform stain should be obtained. A simple special apparatus has been designed to achieve this aim which does not affect the severity of the treatment and which gives results very close to those produced by commercial pleaters. The design of this apparatus will be described later.

5. EFFECT OF FABRIC CONSTRUCTION

On plain dyed styles generally the pleater is concerned only with a change of colour of the coloured material during pleating, except in very heavy depths, when contamination of the pleating formers with dye can be troublesome. In fabrics composed of dyed yarns or blends of coloured, uncoloured, or differently coloured fibres, in addition to a change of colour of the coloured fibre itself, the fabric can show a considerable change in colour resulting from staining of uncoloured or differently coloured fibres in the blend. The loose-fibre, slubbing, or yarn dyer is concerned to obtain information on this effect, as, particularly with fibres dyed with disperse dyes, staining of adjacent fibres is found more frequently than a change in colour of the coloured fibre itself. Moreover, in blends of the above type very slight staining can produce a large change in colour of the fabric composed of the blended fibres. Although an examination of the degree of staining of adjacent undyed fibres gives a very good guide to the behaviour in a blended fabric, it is advisable, where possible, to check on a laboratory-produced blend if large quantities of material are to be processed.

6. EFFECT OF ADJACENT FIBRES

It must not be assumed that in a steam pleating test the adjacent white fabrics are inactive. Very many cases are known where the presence of a

TABLE II

Effect of Adjacent Fibre

(Conditions— 10 min. at 10 lb./sq.in. (0·7 kg./sq.cm.) (115°C.))

	Dyeing	Effect on Dyeing	Staining of Adjacent Fibres		Remarks
(1)	Standard depth of Dispersol Fast Crimson B 150 (C.I. Disperse Red 13) applied to cellulose triacetate. Finished neutral	5	4 (triacetate)	4 (viscose rayon)	The disperse dye is reduced by wool, in the presence of alkali, under the pleating conditions. In the presence of neutral material, or in the absence of wool, no serious change of colour takes place.
(2)	As (1) but finished alkaline (pH 9)	4	4 (triacetate)	4 (viscose rayon)	
(3)	As (1)	4	4 (triacetate)	3–4 (wool)	
(4)	As (2)	2	4 (triacetate)	5 (wool)	
(5)	Standard depth of Durazol Brown BR (C.I. Direct Brown 95) applied to viscose rayon	4–5	5 (triacetate)	5 (viscose rayon)	The direct dye is chemically attacked by the wool under the pleating conditions.
(6)	As (5)	2 yellower	5 (wool)	5 (viscose rayon)	
(7)	Azoic black on Terylene. Dyed with Dispersol Diazo Black B (C.I. Disperse Black 1) and Brenthol OT (C.I. Azoic Coupling Component 18). o-Phenylphenol used as carrier	5	4–5 (Terylene)	5 (viscose rayon)	It is probable that the heavy yellow stain on the nylon results from the action of the 4-nitroso-2-hydroxydiphenyl in the fibre with the amino groups in nylon, forming a yellow azo dye. The nitrosophenol is produced during the development of the azoic dye.
(8)	As (7)	5	4–5 (Terylene)	2 (yellow stain) (nylon)	

particular adjacent fibre has a significant effect upon the result of steam pleating, and some of these are detailed in Table II.

For this reason the nature of the adjacent fibres must be specified when the results of a steam pleating test are reported. Wool, under mildly alkaline conditions, is particularly reactive.

7. EFFECT OF DYEING METHOD

It is not correct to assume that a particular dye has an intrinsic fastness to steam pleating on a given textile material. As is the case with most other fastness tests, the method of application has a very great effect upon the ultimate fastness. Some common causes of large differences in fastness to steam pleating are given in Table III.

Development of a Standard Test Method

It was recognised by the Pleating Fastness Subcommittee that a suitable test should possess as many of the following desirable features as possible—

(1) Reproducibility (an essential requirement)
(2) Good correlation with practical results (an essential requirement)
(3) Simple apparatus which is readily available
(4) Rapid preparation for testing and ease of assessment
(5) Versatility—a single testing method (allowing variations in time and temperature) to cover all fabrics.

In order to obtain information on the accuracy of a simple test, a range of fabrics (Terylene, 6,6-nylon, Tricel, 6-nylon, and viscose rayon subsequently given a crease-resist finish) were dyed to a range of mode shades and tested for fastness to steam pleating by individual members of the Subcommittee. In order to avoid errors in assessment all assessing (on the 1–5 Grey Scales) was done by one member of the Subcommittee, and his assessments were checked by two colleagues. In addition, the range of patterns tested for pleating fastness in the laboratory was also tested by giving them a commercial pleating process. In this initial trial one set of conditions, namely 10 lb./sq. in. (0·7 kg./sq.cm.) (115°c.) for 10 min. was used, although it was realised that these conditions would not, in practice, cover the pleating conditions for the range of fabrics tested. The object of the initial trial was to obtain information on the reproducibility of the test and the correlation with practical conditions. No details of procedure, other than steam pressure, time, and that the test samples should be in contact with adjacent white materials (one piece being of the dyed material), were given to members of the Subcommittee. This absence of detail was deliberate, in order to gain information on the reproducibility of results in the absence of closely defined conditions.

The results showed good reproducibility in the effect of pleating on the dyed test pattern, but a very poor level of reproducibility for staining of adjacent white fibres. Differences of 2 units on the Grey Scale between two testers were not uncommon, particularly for fabrics dyed with disperse dyes. It is considered that this lack of reproducibility in assessing staining of adjacent fibres is of very great importance, particularly to the yarn, loose-fibre, or slubbing dyer, and for this reason more closely defined conditions of test are highly desirable.

The preliminary work described indicates that the proposed French test [2] would not give reproducible results.

An examination of the tested patterns after conclusion of the test suggested that the two main causes of failure to realise reproducibility were (*a*) excessive wetting of the material during steaming, probably caused by water splashing on the material, and (*b*) lack of close and uniform contact between the test pattern and adjacent white materials.

TABLE III

Effect of Dyeing Method on Pleating Fastness

(10 min. at 10 lb./sq.in. (0·7 kg./sq.cm.) (115°c.))

Dyeing	Effect on Dyeing	Staining of Adjacent Fibres		Remarks
(1) 10% Duranol Blue G 300 (C.I. Disperse Blue 26) applied to Terylene at 130°c. using Lissapol D (1/1000) as dyebath assistant	5	3 (Terylene)	3–4 (wool)	When dyeing heavy depths of anthraquinonoid blues on Terylene agents such as Dispersol AC prevent dye aggregation and lead to faster dyeings.
(2) As (1) but replacing Lissapol D by Dispersol AC (3/1000)	5	4–5 (Terylene)	4–5 (wool)	
(3) Dyeing of Duranol Brilliant Blue CB (C.I. Disperse Blue 1) on cellulose triacetate in a viscose–triacetate blend. Crease-resist-finished. Thoroughly washed off	4	5 (triacetate)	5 (viscose rayon)	The formaldehyde released from the unsoaped material affects the colour of the dyed material.
(4) As (3), but no wash-off after crease-resist-finish	2	5 (triacetate)	5 (viscose rayon)	
(5) Dyeing of Alizanthrene Navy Blue R (C.I. Vat Blue 18) on cotton. Very thorough soap at the boil	5	5 (cotton)	5 (nylon)	The steaming during the pleating test completes the colour change which should normally take place on soaping.
(6) As (5) but soaped at 85°c.	3	5 (cotton)	5 (nylon)	

After further discussions by the Pleating Fastness Subcommittee it was thought that the problem of uncertain contact between the specimen and the adjacent white materials could be resolved by using a holder modified from a design suggested by Mr. R. Broadhurst. This holder maintains a close contact between the specimen and the adjacent white materials, but avoids the drawbacks of (*a*) having materials of high heat capacity in contact with the specimens under test, which would cause too great a condensation of water to allow correlation with a practical pleating process, and (*b*) preventing contact of steam with the specimen. In addition, the proposed holder is easily constructed and can be readily made in a laboratory. A plan of the holder, which was adopted provisionally, is given in Fig. 1.

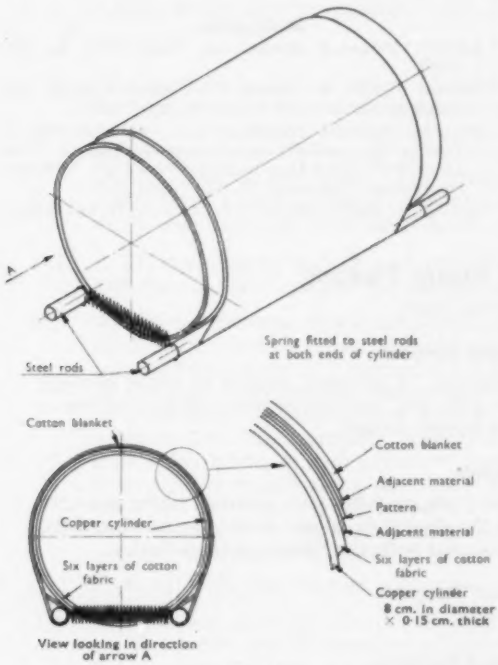
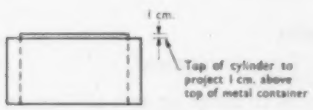


FIG. 1



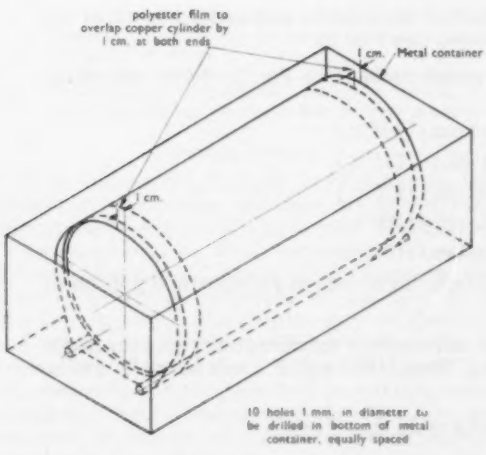

polyester film to overlap copper cylinder by 1 cm. at both ends
1 cm.
Metal container
1 cm.
10 holes 1 mm. in diameter to be drilled in bottom of metal container, equally spaced

FIG. 2

The problem of excessive wetting of the pattern during test can be solved by carrying out the steaming treatment in a pressure steamer with an outer steam jacket, which eliminates condensation of water, or by carrying out the test in a domestic pressure cooker, provided that certain essential precautions are taken. The precautions which have proved necessary in the use of a pressure cooker are—

(1) The entire holder containing the test patterns is wrapped in one complete layer of polyester film. The film should project 1 cm. beyond the ends of the holder, but should not be closed.

(2) The holder should be contained in an open metal container as illustrated in Fig. 2. The container should have ten 0·1-cm. holes equally spaced across the bottom, and its height should be approx. 7 cm., so that it is 1 cm. short of the top of the specimen holder.

(3) The dimensions of the domestic pressure cooker should be adequate for the container to be held by an appropriate stand at least 5 cm. from the surface of the water. If this is not done, there is a danger of the patterns being wetted by boiling water. A pressure cooker 23 cm. in diameter and 26 cm. high has been found suitable.

Using these modifications (initially the tube of the holder was composed of compressed paper 0·5 cm. thick, but subsequently a copper tube was substituted) a similar series of tests to those already described was carried out by the Subcommittee. Excellent reproducibility was achieved both in respect of the effect on the dyed material and also of the degree of staining of adjacent undyed material. In addition, the stain achieved on adjacent undyed material was very uniform, which assisted accurate assessment. On this basis the Subcommittee considered that a good foundation had been obtained for a standard testing procedure.

Although the Pleating Fastness Subcommittee realised that a single test— e.g. 10 lb./sq.in. (0·7 kg./sq.cm.) (115°c.) for 10 min.— would be convenient, this would not adequately cover the range of fastnesses required, as certain fabrics are pleated for as little as 5 min. at 5 lb./sq.in. (0·35 kg. per sq.cm.) (108°c.), whilst other fabrics require 15 min. at 20 lb./sq.in. (1·41 kg./sq.cm.) (126°c.). It was therefore thought that, provisionally, there should be three tests, as follows—

TEST UK 1—Mild: 5 min. at 5 lb./sq.in. (0·35 kg./sq.cm.) (108°c.)
TEST UK 2—Moderate: 10 min. at 10 lb./sq.in. (0·7 kg./sq.cm.) (115°c.)
TEST UK 3—Severe: 15 min. at 20 lb./sq.in. (1·41 kg./sq.cm.) (126°c.)

(Test UK 3 is used only for fully synthetic fibres such as polyester and polyamide fibres.)

It is realised that the above three sets of conditions will not be ideal for all fabrics, but it is considered that they will adequately cover the range required.

* * *

This report and the proposed tests (details given below) were submitted to I.S.O. for consideration by the Subcommittee ISO/TC 38/SC 1—Documents No. 183 and 185. The tests were accepted as tentative providing that two additional tests (F 1 and F 2) were included.

References

[1] AATCC, *Technical Manual and Year Book*, **33**, 110 (1957).
[2] Institut Textile de France, Commission d'Étude des Essais de Solidité des Teintures (April 1958).
[3] Imperial Chemical Industries Ltd., "The Dyeing of Viscose Rayon–Cellulose Triacetate Unions: The Fastness of Direct Dyes to Steam Pleating", *Technical Information* (*Dyehouse*) No. 304 (April 1956).
[4] Fern, A. S., and Hadfield, H. R., J.S.D.C., **71**, 840 (1955).

Colour Fastness to Steam Pleating

(ISO TENTATIVE TEST)

1. Purpose and Scope

1.1 This method is intended for assessing the fastness of coloured textiles to steam pleating processes. The materials are not pleated during the test, and it is emphasised that the test is not intended for assessing the quality of the pleating process.

2. Principle

2.1 Specimens of the coloured textile (loose fibre, yarn, or fabric) are steamed under pressure in contact with adjacent undyed fabric, and the change in colour of the specimen and the staining of the adjacent undyed fabric are assessed with the Standard Grey Scales.

3. Apparatus and Reagents

3.1 Specimen holder (see Fig. 1)

3.2 Grey Scales for assessing Change in Colour and Staining

3.3 Undyed neutral scoured wool and, if the specimen to be tested is not wool, undyed scoured fabric composed of the major component of the fabric.

4. Specimens

4.1 If the textile material is cloth, a piece 4 cm. × 5 cm. is required.

4.2 If the textile is loose fibre or yarn, comb out so as to cover an area of 4 cm. × 5 cm.

5. Procedure

5.1 Dry the specimen and the fabrics on the specimen holder.

5.2 Mount the specimen on the holder between undyed wool fabric and undyed fabric of the same fibre as the main component of the specimen (see Fig. 1).

5.3 Steam either in a jacketed steamer or in a pressure cooker (see Fig. 2). Select one of the following conditions (see § 7.4)—

Test UK 1— 5 min. at 5 lb./sq.in. (0·35 kg./sq.cm.) (108°c.)
Test UK 2— 10 min. at 10 lb./sq.in. (0·7 kg./sq.cm.) (115°c.)
Test UK 3— 15 min. at 20 lb./sq.in. (1·41 kg./sq.cm.) (126°c.)
Test F 1— 30 min. at 5 lb./sq.in. (0·35 kg./sq.cm.) (108°c.)
Test F 2— 20 min. at 25 lb./sq.in. (1·76 kg./sq.cm.) (130°c.)

(Tests UK 3 and F 2 are used only for fully synthetic fibres such as polyester and polyamide fibres.)

5.4 For tests UK 3 and F 2 omit the adjacent wool and use only the fibre comprising the major constituent of the specimen, unless this is wool. Tests UK 3 and F 2 will normally not be used on wool fabrics.

5.5 Release the steam pressure. (This should not take more than 2 min.)

5.6 Remove the specimen and adjacent materials, dry, allow to condition for 4 hr.

5.7 Assess the change in colour and the staining of undyed adjacent fabrics with the grey scales. The control untreated adjacent white fabric should be steamed, in the absence of a coloured specimen, before use for comparison purposes.

6. Report

6.1 Report the numerical ratings for change in colour and for staining of adjacent undyed fabrics, which must be specified.

7. Notes

7.1 The specimen holder consists of a copper tube 8 cm. in external diameter. The thickness of the copper is 0·15 cm. The copper tube is wrapped with six layers of bleached cotton cloth (wt. = 3·7 oz./sq.yd.) (125 g./sq.metre). The outside wrapper is made from bleached cotton cloth (wt. = 5·5 oz./sq.yd.) (186 g./sq.metre). The rods at each end are made from 0·6 cm. diameter soft steel. The strength of the springs is not critical, but it must be sufficient to hold the wrapper tightly against the tube. The springs are fastened to one of the steel rods and must easily hook on to the other steel rod (see Fig. 1).

7.2 A jacketed steamer may be used providing that the pressure can be accurately determined and that no water splashes on the specimen during test.

7.3 A domestic pressure cooker can be used as an alternative to a jacketed steamer. The dimensions of the pressure cooker should be sufficiently large to avoid water splashing on to the specimen during test; it is suggested that the minimum size should be 23 cm. in diameter and 26 cm. high. The domestic pressure cooker must be fitted with an accurate pressure gauge. If a domestic pressure cooker is used, the holder must be wrapped in one layer of polyester film, which projects 1 cm. over each end of the holder and is not closed at the ends. The holder is then placed in a rectangular metal container containing ten 0·1-cm. holes equally spaced along the centre of the bottom, and should be sufficiently deep to reach to 1 cm. from the top of the holder. The container is then placed on a stand which holds it 5 cm. from the surface of the water. The quantity of water in the cooker is not critical, but water to a depth of 3 cm. is suggested.

Expel air from the pressure cooker for 2 min. before raising the pressure.

7.4 This test was developed by the Pleating Fastness Subcommittee of the Society of Dyers and Colourists, and its proposal was accepted as an ISO tentative test, subject to the inclusion of two additional tests at present in use in France. The letters UK and F have been used to distinguish between the test conditions proposed by the United Kingdom and by France respectively.

COMMUNICATION

A Study of the Spectral Dependence of the Fading of Dyed Textiles

R. E. BEDFORD

A method for calculating the contributions of various spectral regions of light in causing fading is described, and results are given for three dyed samples. The materials were exposed to sunlight plus skylight, for which the spectral energy distribution is rather well known, behind a set of coloured filters. Fading was measured as an actual colour change by means of the Hunter colour-difference meter. A set of simultaneous equations is set up whose solution gives the relative efficiencies of the various regions in producing fading. A comparison of various equations to describe fading is also made.

INTRODUCTION

It is well known that all wavelengths in the ultraviolet and visible spectrum are not equally effective in causing the fading of dyes. Fading may be produced only by those wavelengths absorbed by the material, and hence is dependent on the spectral reflectance properties of the dye. It is also true that some wavelengths may be absorbed and yet play no part in the fading mechanism. A knowledge of the relative "fading efficiencies" of the various spectral regions is of importance when comparing light fastness assessments made by exposure to sources of different spectral energy distributions, e.g. fading lamps and daylight. The question is also of particular interest to shopkeepers who wish to display coloured textiles in their store windows and reduce fading to a minimum by a suitable choice of coloured window shades. Early investigations of this problem [1, 2] disproved the original suggestions that most fading was due to the ultraviolet radiation, and in fact showed that visible radiations were in some cases even more efficient. Recently McLaren [3] has considered the problem from a more fundamental point of view and has given detailed results for many dyes.

The present study was initiated to test the applicability of another method for estimating the

contributions to fading of the various spectral regions. The investigation revealed a number of interesting features of the fading process.

EXPERIMENTAL

Since the purpose of the work was to test the feasibility of the method rather than to obtain detailed results for particular dyes, only three dyed samples were used. Also, since one would wish the method to be applicable to any type of dyed material, mixtures of dyes were used in two cases, and two types of substrates were used. The three samples will henceforth be designated as the *blue*, *green*, and *red* samples respectively. The dyes employed were Chlorantine Fast Blue 4GL (C.I. 34200) for the blue sample, Durazol Red 2B (C.I. 28160) and Chlorantine Fast Bordeaux 2B (C.I. Direct Red 100) for the red sample, and Fastusol Yellow 5G (C.I. 13950) and Rigan Sky Blue G (C.I. Direct Blue 40) for the green sample. These are all direct dyes. The substrate was mercerised cotton for the blue and red samples and unmercerised cotton for the green. The spectral reflectance curves of the three samples as measured with the General Electric recording spectrophotometer are shown in Fig. 1. The reflectances in the ultraviolet and infrared could not be conveniently determined.

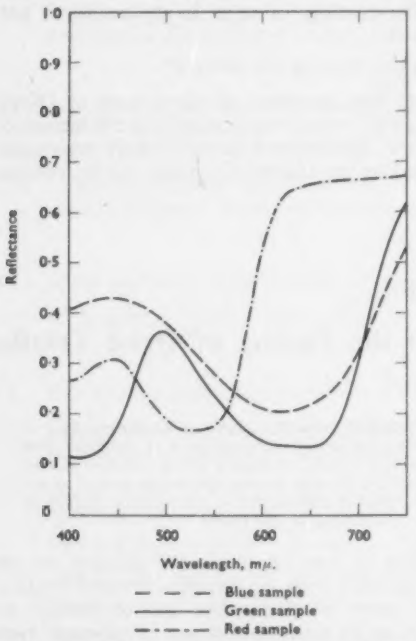


FIG. 1— Spectral Reflectance Curves of the Three Dyed Samples

The method was similar to that employed by previous investigators [2, 3] in that the material was exposed behind a set of coloured filters, as many as sixteen filters being used in the case of the green sample. Eight filters were used for the blue and red samples. All filters were of glass, 2 in. square, and their spectral transmittances were measured on a Cary recording spectrophotometer in the region 0·3–2·5 μ. An opaque metal square was also used to cover one portion of the material, and the unfaded cloth under it was in all cases used as the reference. The tristimulus values of these reference areas were calculated from the spectral reflectance curves (Fig. 1) for Standard Source C, and from these the quantities L, a, b of the Hunter colour-difference meter were calculated by means of equations (i) [4]—

$$L = 100\ Y^{\frac{1}{2}}$$
$$a = \frac{175\ (1{\cdot}02X - Y)}{Y^{\frac{1}{2}}}$$
$$b = \frac{70\ (Y - 0{\cdot}847\ Z)}{Y^{\frac{1}{2}}} \qquad \text{(i)}$$

where X, Y, Z are the tristimulus values.

Before exposure the colour of each portion of the dyed material was measured relative to the reference area using the Hunter colour-difference meter. The filters were then placed on the material in a shallow container, and the assembly was exposed to sunlight plus skylight on an unobstructed horizontal surface. The roof of the container consisted of fused quartz, which transmitted uniformly from 0·3 μ. to 2 μ., the transmission falling off gradually outside this region. Exposures ran continuously, day and night, regardless of weather conditions. The reason for this type of exposure will be made clear later. At intervals during the course of the exposure the amount of fading through each filter was measured with the Hunter meter by determining the colour of the faded portions relative to that of the unfaded reference area. These measurements, together with the similar measurements before exposure, allowed calculation of the colour difference between the faded and unfaded material for each filter. Thus if L_1, a_1, b_1 are the coordinates of one area before exposure, and L_2, a_2, b_2 are the coordinates of the same area after an exposure, then—

$$\Delta E = [(L_1 - L_2)^2 + (a_1 - a_2)^2 + (b_1 - b_2)^2]^{\frac{1}{2}} \qquad \text{(ii)}$$

is the desired colour difference in N.B.S. units*. ΔE is then a measure of the degree of fading which has occurred.

The duration of the exposure was not measured in hours, but rather in terms of the total radiation (cal./sq.cm.) received, these measurements being made with a standard Eppley pyrheliometer, which measures the intensity of solar radiation on a horizontal plane. Each material was exposed until considerable fading had occurred through at least one filter, by which time several points on the fading curve had been determined.

The general principle of the method of determining the spectral dependence of the fading was to divide the spectrum (0·3–2·0 μ.) into, say, n relatively narrow wavelength bands and, from a knowledge of the spectral energy distribution of sunlight plus skylight, the transmission of the filters, and the fading by each filter, to set up a system of n equations in n unknowns and so solve for the quantities in question. Some modification

* The units of ΔE thus calculated are not exactly N.B.S. units, but are very closely the same [4].

of this process was necessary, as shown in the next section. The spectral energy distribution used was that given by Middleton [5] for the ultraviolet and visible regions and by Moon [6] for the infrared, and is tabulated in Table I. It has been shown by Hull [7] that the relative distribution of energy in the spectrum of sunlight plus skylight is affected only slightly by changing atmospheric conditions, and so the distribution used was considered accurate enough for the purpose. It was for this reason also that the samples were exposed continuously, as mentioned above. Although the fading process is dependent on humidity and temperature, this should cause no gross relative errors here, since all portions of the cloth, including the reference area, are subject to identical conditions.

The transmission properties of the filters used are indicated in Table II, which gives the average transmission of each filter in each of ten wavelength bands. The colours of the various filters are also indicated.

RESULTS AND DISCUSSION

A plot of the fading of the red dye sample against the total radiation of sunlight plus skylight is given in Fig. 2 for each of filters No. 2–9*. It is evident that the rate of fading is strongly dependent on the spectral character of the radiation. In comparing the fading through the various filters, one must, of course, also remember that some filters have higher transmissions than others

* The numbering of the filters in all cases corresponds to that given in Table I.

TABLE I

Relative Values of the Spectral Energy Distribution of Sunlight plus Skylight on a Horizontal Surface

(Values of W_λ are for 0·01-μ. bands centred on the wavelengths shown)

λ (μ.)	W_λ (arbitrary units)	λ (μ.)	W_λ (arbitrary units)	λ (μ.)	W_λ (arbitrary units)
< 0·30	0	0·53	1810	0·78	1130
0·30	50	0·54	1800	0·79	1150
0·31	300	0·55	1770	0·80	1070
0·32	680	0·56	1730	0·81	870
0·33	1050	0·57	1700	0·82	1000
0·34	1000	0·58	1680	0·83	1080
0·35	1080	0·59	1660	0·84	1070
0·36	1090	0·60	1610	0·85	1050
0·37	1270	0·61	1590	0·86	1020
0·38	1180	0·62	1580	0·87	1000
0·39	1120	0·63	1550	0·88	770
0·40	1520	0·64	1540	0·89	650
0·41	1840	0·65	1510	0·90	600
0·42	1830	0·66	1480	0·91	470
0·43	1660	0·67	1460	0·92	320
0·44	1920	0·68	1440	0·93	210
0·45	2050	0·69	1220	0·94	350
0·46	2070	0·70	1380	0·95	610
0·47	1940	0·71	1340	0·96	730
0·48	1920	0·72	1040	0·97	790
0·49	1840	0·73	1210	0·98	810
0·50	1840	0·74	1300	0·99	800
0·51	1820	0·75	1080	1·00	790
0·52	1750	0·76	710	1·00–2·50	10,000
		0·77	1210		

TABLE II

Average Transmission of the Sixteen Filters in each of Ten Spectral Regions

(A gap in the table indicates zero transmission)

Filter	Colour	Wavelength, mμ. 300–350	350–400	400–450	450–500	500–550	550–600	600–650	650–700	700–1000	1000–2500
2	Violet	$0{\cdot}000_1$	0·150	0·298	0·029	—	—	—	—	—	0·003
3	Ultraviolet	0·826	0·571	0·006	—	—	—	—	0·032	0·123	0·015
4	Blue–violet	$0{\cdot}000_8$	0·283	0·731	0·560	0·116	0·002	—	—	0·719	0·225
5	Blue	—	0·133	0·591	0·586	0·253	0·023	—	—	0·623	0·262
6	Violet	0·515	0·833	0·597	0·111	$0{\cdot}000_3$	—	—	0·011	0·819	0·225
7	Greenish blue	0·030	0·631	0·816	0·849	0·838	0·618	0·223	0·032	$0{\cdot}000_8$	0·333
8	Green	—	—	0·001	0·188	0·638	0·576	0·303	0·212	0·311	0·756
9	Orange–red	—	—	—	—	—	0·070	0·817	0·866	0·818	0·816
10	Red	—	—	—	—	—	—	0·355	0·885	0·880	0·874
11	Infrared	—	—	—	—	—	—	—	—	0·195	0·810
12	Deep red	—	—	—	—	—	—	0·005	0·333	0·702	0·791
13	Neutral	—	0·002	0·010	0·017	0·020	0·022	0·022	0·022	0·008	0·022
14	Neutral	—	0·006	0·028	0·043	0·048	0·052	0·053	0·052	0·020	0·049
15	Neutral	$0{\cdot}000_1$	0·027	0·086	0·114	0·124	0·130	0·131	0·129	0·066	0·120
16	Neutral	$0{\cdot}000_5$	0·066	0·164	0·203	0·214	0·222	0·224	0·222	0·131	0·199
17	Neutral	0·003	0·134	0·268	0·311	0·324	0·332	0·334	0·332	0·228	0·320

on the average, and that this affects the relative positions of the curves. For example, filter No. 2 allows only slight fading, but, on the other hand, it also has a very low transmission. Certain qualitative features are immediately evident. Filters 3, 6, 7 produce by far the most fading, and Table II shows that these three transmit highly in the ultraviolet. Hence for this particular dye most of the fading is caused by ultraviolet radiation.

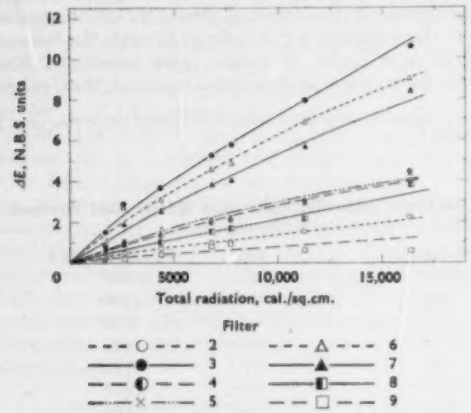


FIG. 2— Fading of Red Dyed Sample as a function of Total Radiation of Sunlight plus Skylight (curves are shown for Filters 2–9)

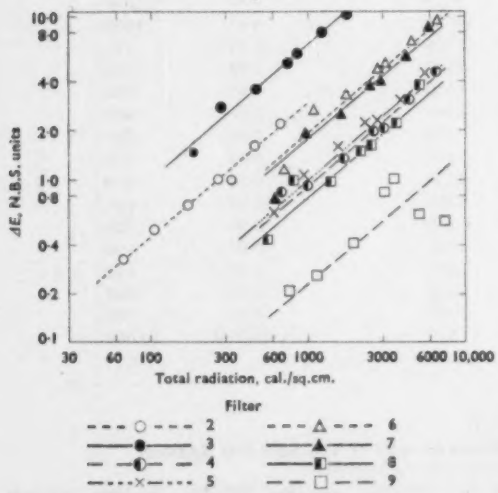
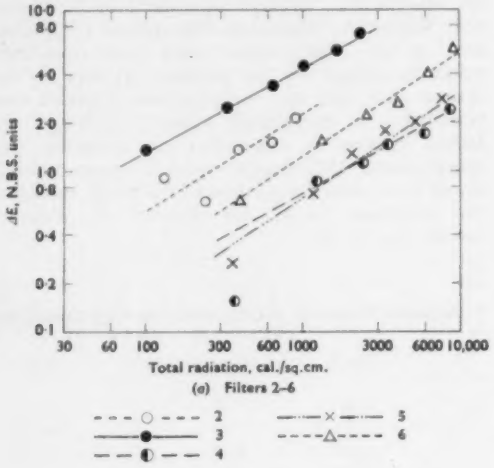


FIG. 3— Logarithmic Plot of Fading of Red Dyed Sample as a function of the Total Radiation transmitted by the Filters

Fig. 3 shows the same data plotted in a different way. From the known transmissions of the filters, and from the spectral energy distribution of Table I, one can compute the fraction of the total radiation received which actually reaches the cloth through each filter. In Fig. 3 a logarithmic plot is made of the amount of fading (N.B.S. units) *versus* the radiation actually reaching the cloth. We see that the experimental points for each filter lie very closely on straight lines. The relative effectiveness of the various filters in preventing fading may now be seen in proper perspective, since the curves are corrected for filter transmission. A striking feature of Fig. 3 is that all the lines are parallel. This is not generally true, as will be seen for the blue and green samples.



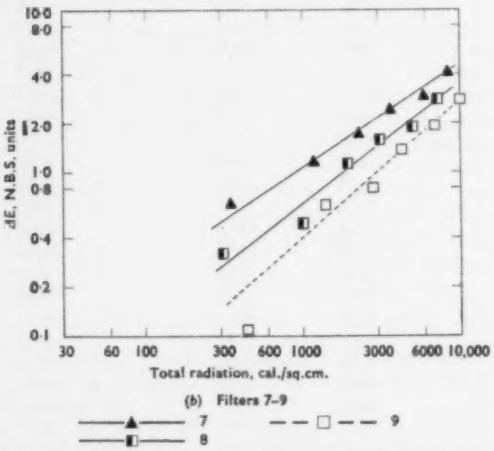


FIG. 4— Logarithmic Plot of Fading of Blue Dyed Sample as a function of the Total Radiation transmitted by the Filters

The fading of the blue sample is shown in Fig. 4, where the method of plotting is similar to that in Fig. 3. Again the ultraviolet contributes most to the fading. This time, however, the red wavelengths produce fading comparable to that of other regions of the visible spectrum. Whereas for the red dye all lines are parallel, this is not true in the present case.

Fig. 5 gives similar results for the green dye. As is to be expected, the least fading is contributed by green and blue–green wavelengths, while the red now produces a large part of the colour change. Ultraviolet seems still to be the predominant band. Wavelengths beyond about 700 mμ. seem to be rather ineffective, in agreement with earlier data. As for the blue dye, the lines for various filters are

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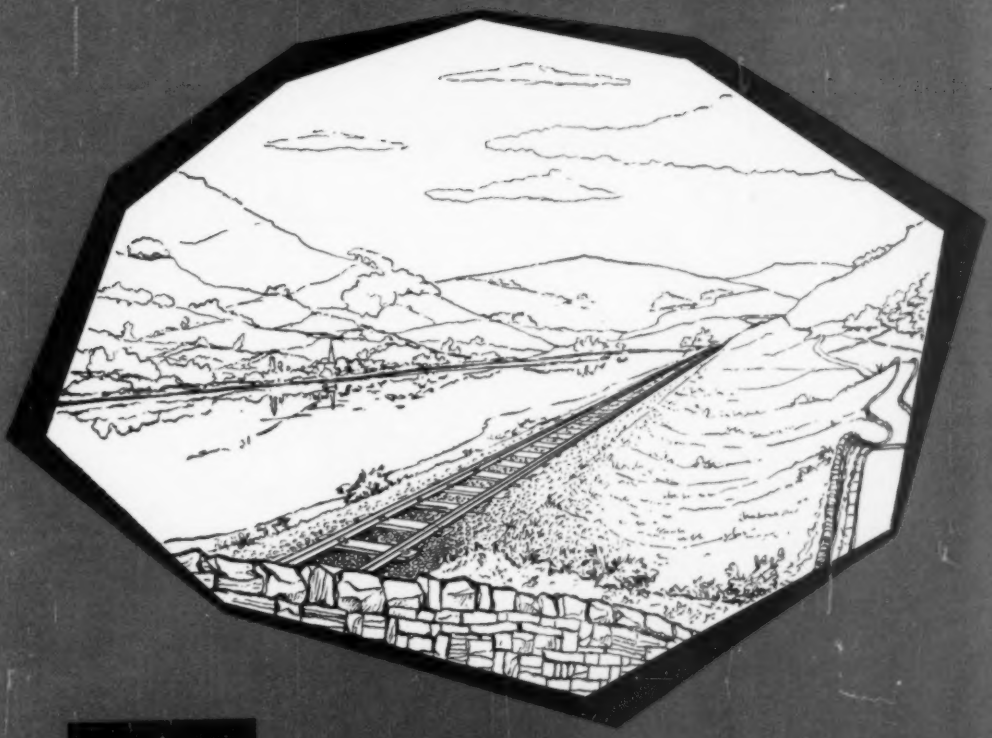

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on the average, and that this affects the relative positions of the curves. For example, filter No. 2 allows only slight fading, but, on the other hand, it also has a very low transmission. Certain qualitative features are immediately evident. Filters 3, 6, 7 produce by far the most fading, and Table II shows that these three transmit highly in the ultraviolet. Hence for this particular dye most of the fading is caused by ultraviolet radiation.

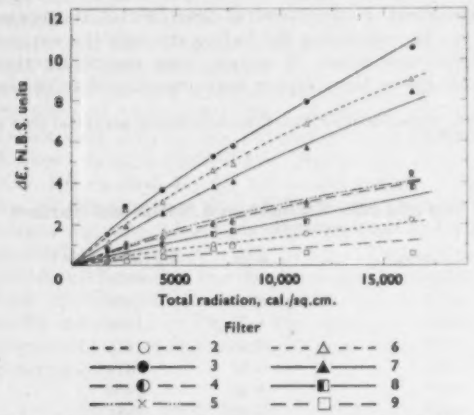


FIG. 2— Fading of Red Dyed Sample as a function of Total Radiation of Sunlight plus Skylight (curves are shown for Filters 2–9)

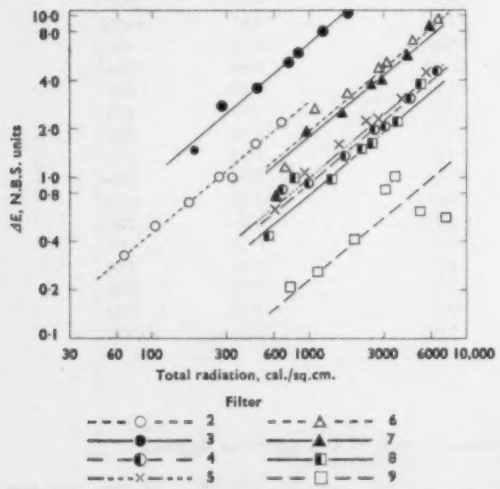
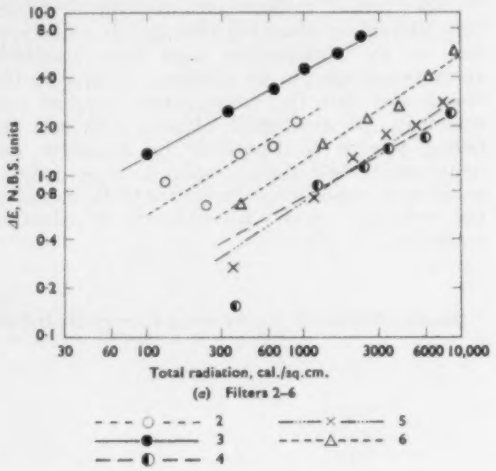


FIG. 3— Logarithmic Plot of Fading of Red Dyed Sample as a function of the Total Radiation transmitted by the Filters

Fig. 3 shows the same data plotted in a different way. From the known transmissions of the filters, and from the spectral energy distribution of Table I, one can compute the fraction of the total radiation received which actually reaches the cloth through each filter. In Fig. 3 a logarithmic plot is made of the amount of fading (N.B.S. units) *versus* the radiation actually reaching the cloth. We see that the experimental points for each filter lie very closely on straight lines. The relative effectiveness of the various filters in preventing fading may now be seen in proper perspective, since the curves are corrected for filter transmission. A striking feature of Fig. 3 is that all the lines are parallel. This is not generally true, as will be seen for the blue and green samples.



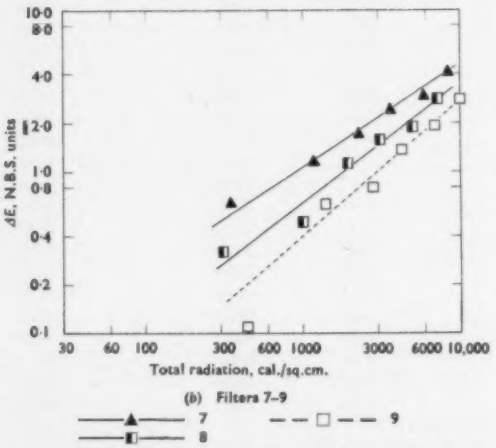


FIG. 4— Logarithmic Plot of Fading of Blue Dyed Sample as a function of the Total Radiation transmitted by the Filters

The fading of the blue sample is shown in Fig. 4, where the method of plotting is similar to that in Fig. 3. Again the ultraviolet contributes most to the fading. This time, however, the red wavelengths produce fading comparable to that of other regions of the visible spectrum. Whereas for the red dye all lines are parallel, this is not true in the present case.

Fig. 5 gives similar results for the green dye. As is to be expected, the least fading is contributed by green and blue–green wavelengths, while the red now produces a large part of the colour change. Ultraviolet seems still to be the predominant band. Wavelengths beyond about 700 mμ. seem to be rather ineffective, in agreement with earlier data. As for the blue dye, the lines for various filters are

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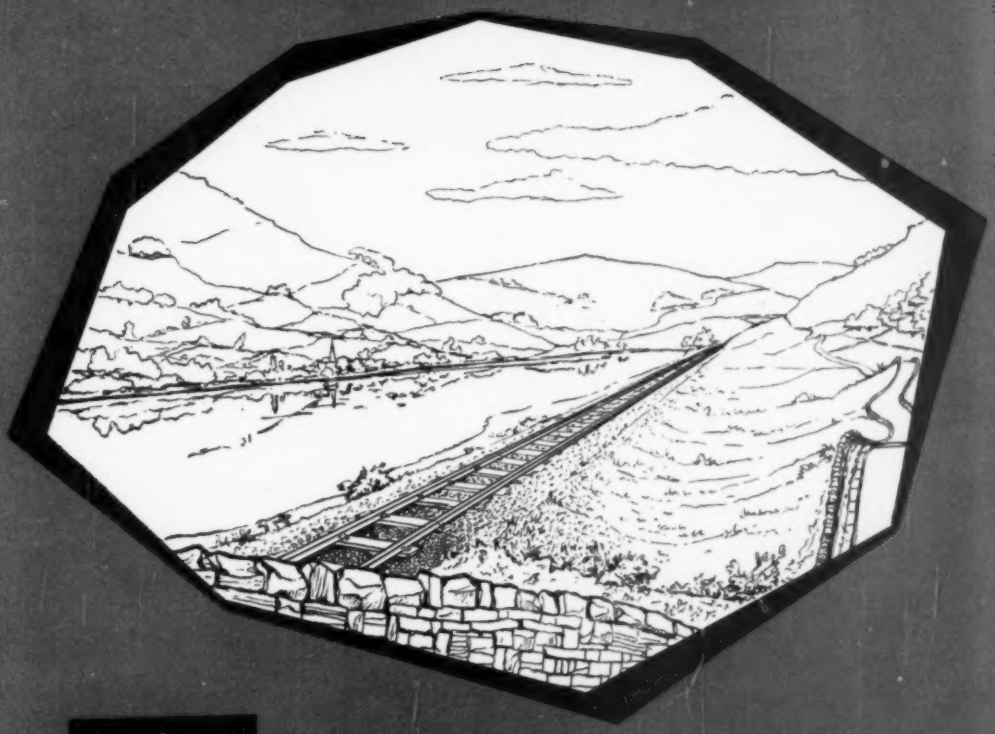

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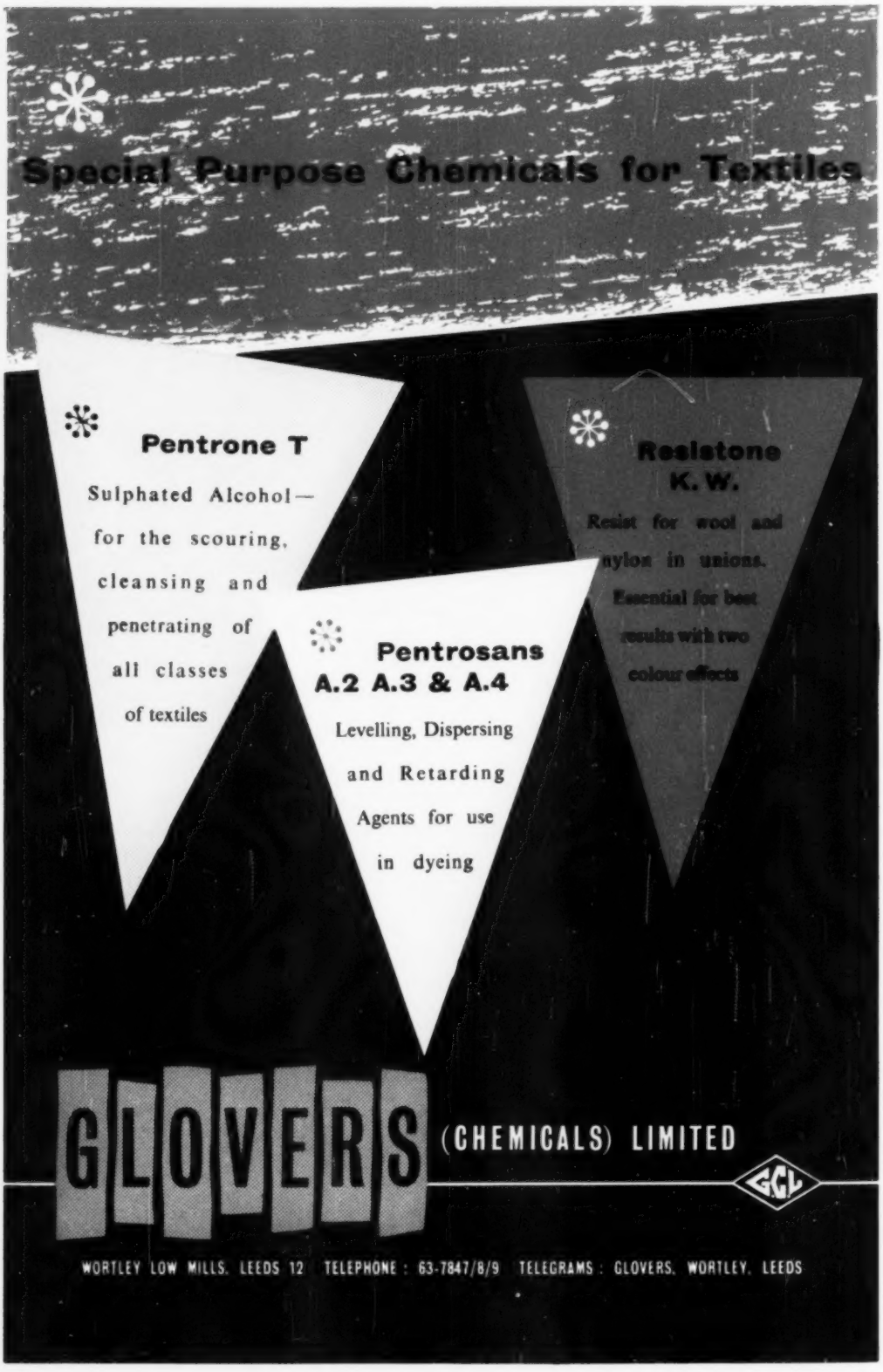
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Cibalan Red Brown RL

a bright reddish brown
which is especially recommended
for the production of
rust and copper shades
which are fast to light
and water spotting,
and is particularly suitable
for carpet yarns
and loose wool

Shading Group I

®Cibalan Red Brown RL

CIBA CLAYTON LIMITED
Clayton Manchester 11
Telephone East 1341 (16 lines)
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Sole Concessionaire in the U.K.
for CIBA Ltd Basle Switzerland

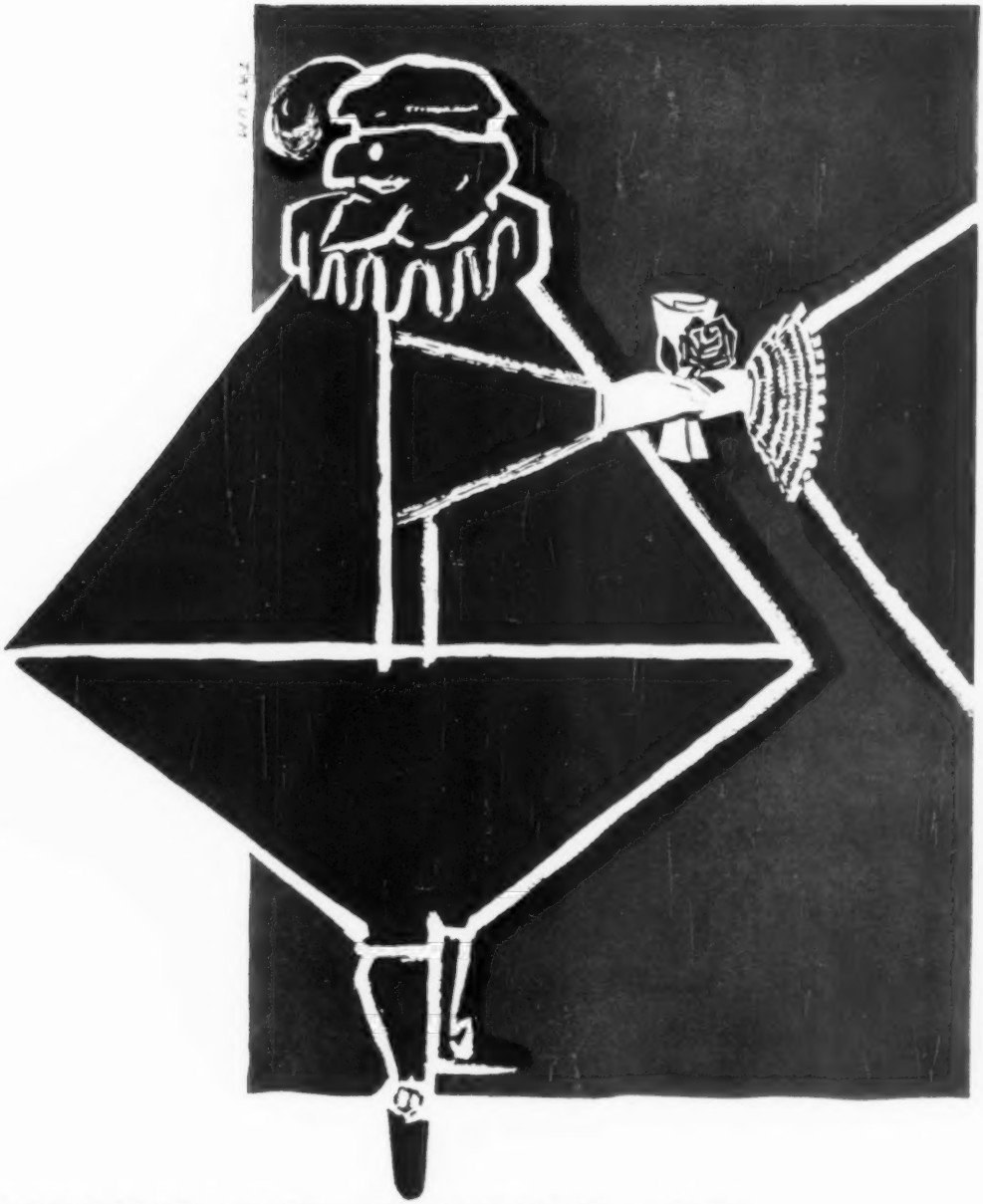
®Registered trade-mark

"Terylene" is the registered trade name of I.C.I's polyester fibre.

"Acrilan" is the registered trade name of the modified acrylic fibre made by Chemstrand Ltd.

YDC

THE YORKSHIRE DYEWARE & CHEMICAL CO LTD · LEEDS



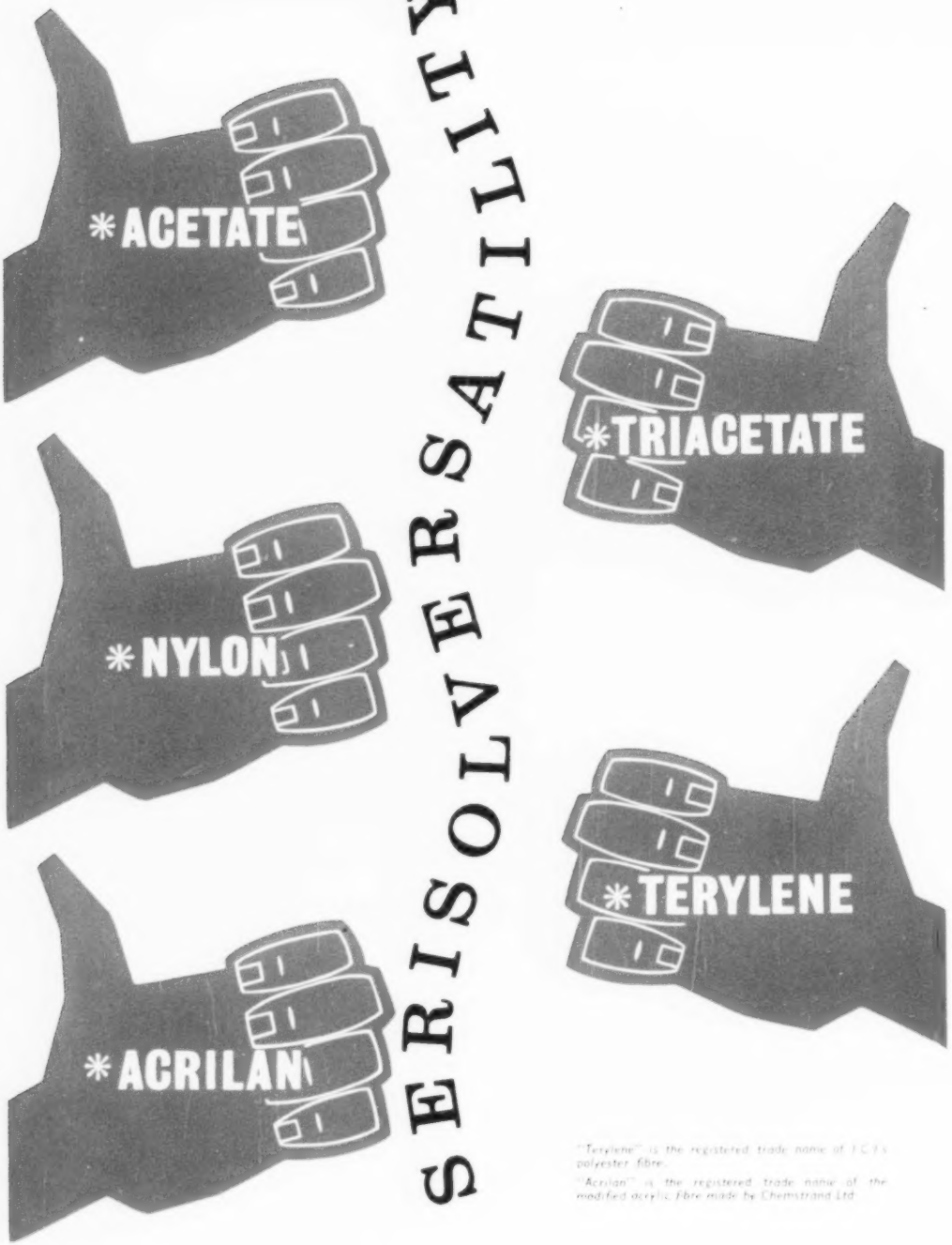
CARBOLAN RUBINE 2B

An acid milling dyestuff with good level dyeing properties for wool.

Has good all round wet-fastness properties and good light-fastness.
Has good building-up properties.
Applicable to loose wool and slubbing.
Suitable for dyeing wool yarn by the Carbolan Salt Method.
Gives economic bright bluish-red shades.

Full information on request.
Imperial Chemical Industries Ltd London SW1 England

D.983



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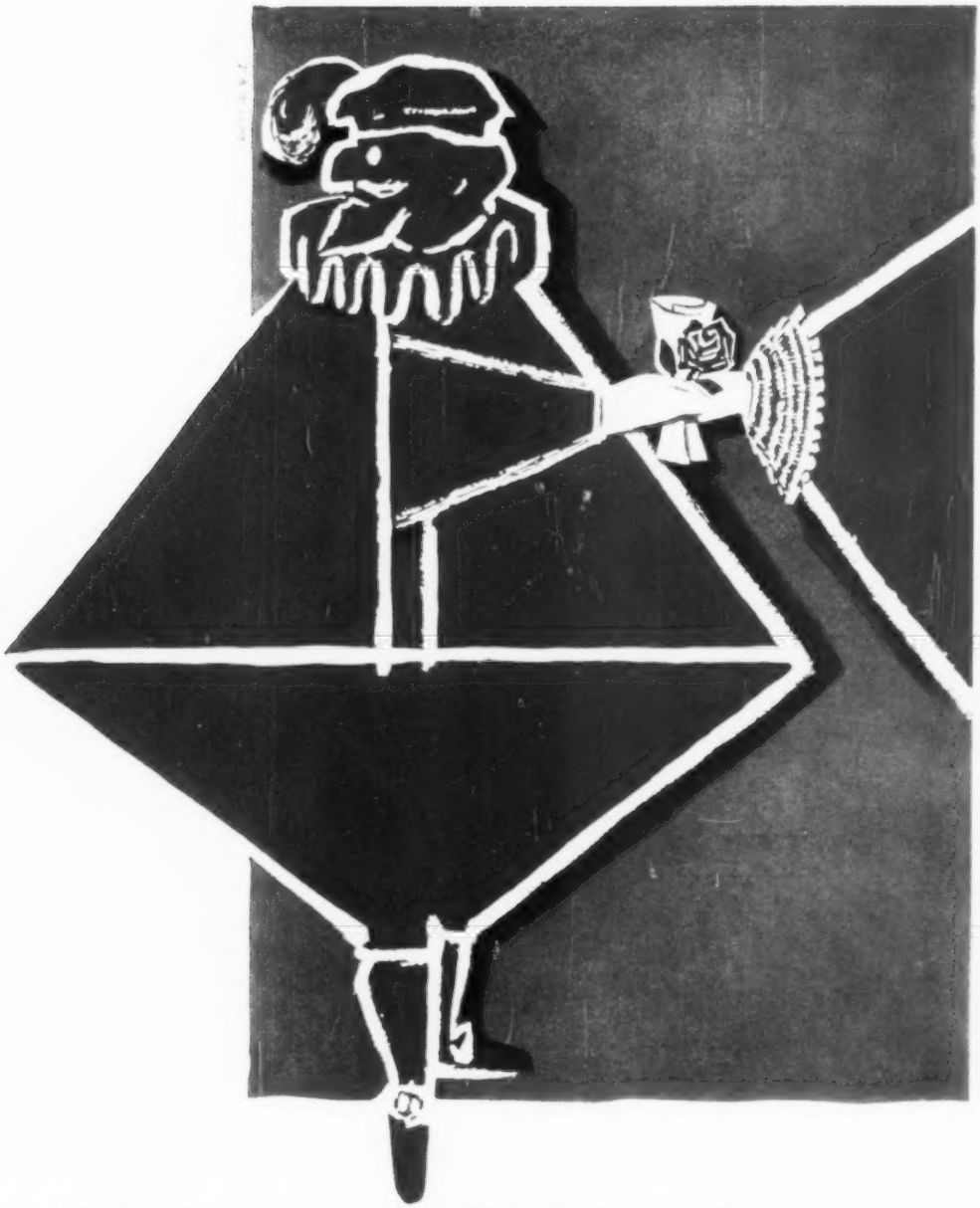

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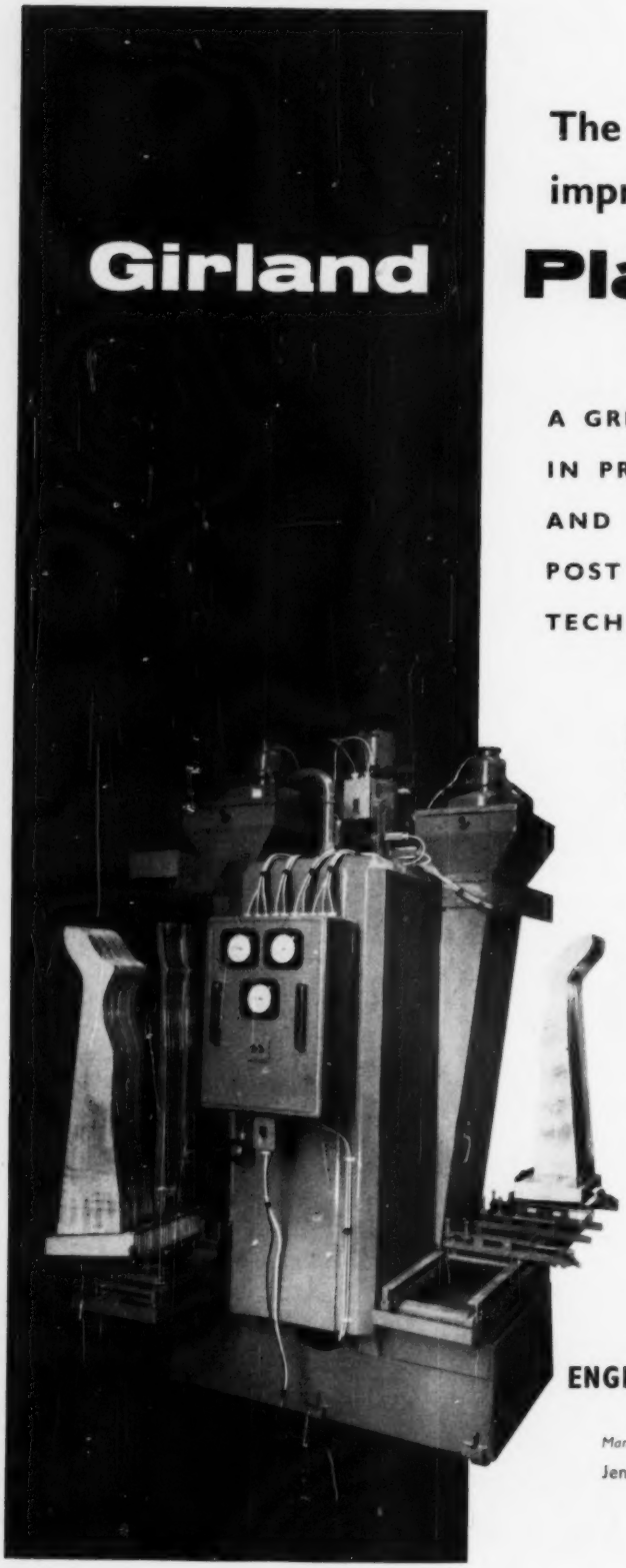
Girland



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A GREAT ADVANCE
IN PREBOARDING
AND
POST BOARDING
TECHNIQUES

Here are the features which make the GIRLAND PLASTICISER the most successful machine of its kind —

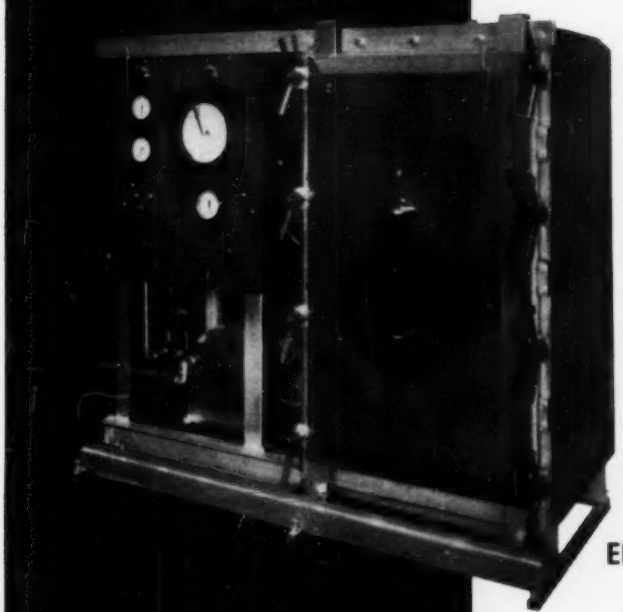
- Separate steam inlet and exhaust systems
- Uniform temperature throughout interior of steam chest
- Easy and quick change form carriage with detachable form holder
- Heater units for post-boarding the heavier weights of nylon, 'Terylene' and Agilon hose and half-hose
- Several types of temperature control equipment available

THE ANDREW
ENGINEERING & DEVELOPMENT
COMPANY LIMITED
Manufacturers of Hosiery Dyeing and Finishing Machinery
Jennison Street · Bulwell · Nottingham
Telephone 27-8566 (4 lines)

Andrew

The Auto-Setter

- AUTOMATIC OPERATION
- THERMOSTATIC TEMPERATURE CONTROLLER
- TEMPERATURE RECORDER
- CAPACITY 100 DOZENS PLUS
- SIX MONTHS GUARANTEE



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Low pressure model for ladies hosiery

Gas fired or electrode steam generating units available

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Manufacturers of Hosiery Dyeing and Finishing Machinery

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Telephone 27-8566 (4 lines)

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Your skill . . . and chemicals

by **Brotherton**

CHEMICALS PACKED IN MULTI-WALL, POLYTHENE LINED PAPER SACKS

Hexamine
Sodium Bisulphite
Sodium Metabisulphite
Sodium Sulphite Anhydrous Powder
Sodium Sulphite Commercial Crystals

A powerful, unbeatable combination . . . your skill, and chemicals by Brotherton.

Brothertons have held an honoured place in chemical manufacture for over eighty years— and those decades of experience are behind everything we sell, everything we do.

The Brotherton representative has our complete organisation behind him. If there is any problem he can't solve "on the spot", he will refer it to our Technical Service Division, who will spare no effort to provide you with the answer.

Our advice is yours for the asking

ALSO Sodium Hydrosulphite Sulphoxylates Ammonia Liquid Sulphur Dioxide Sodium Formaldehyde Bisulphite

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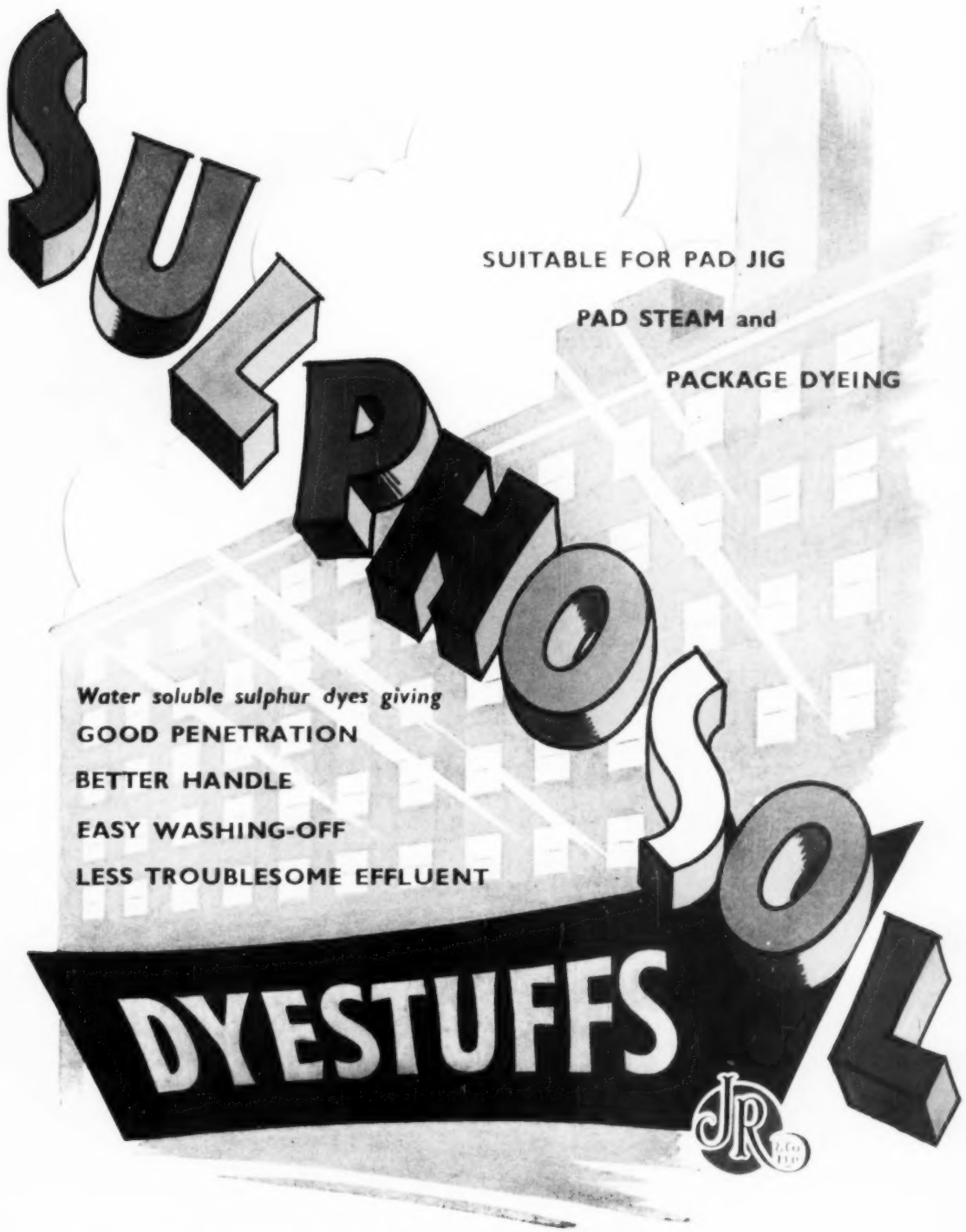

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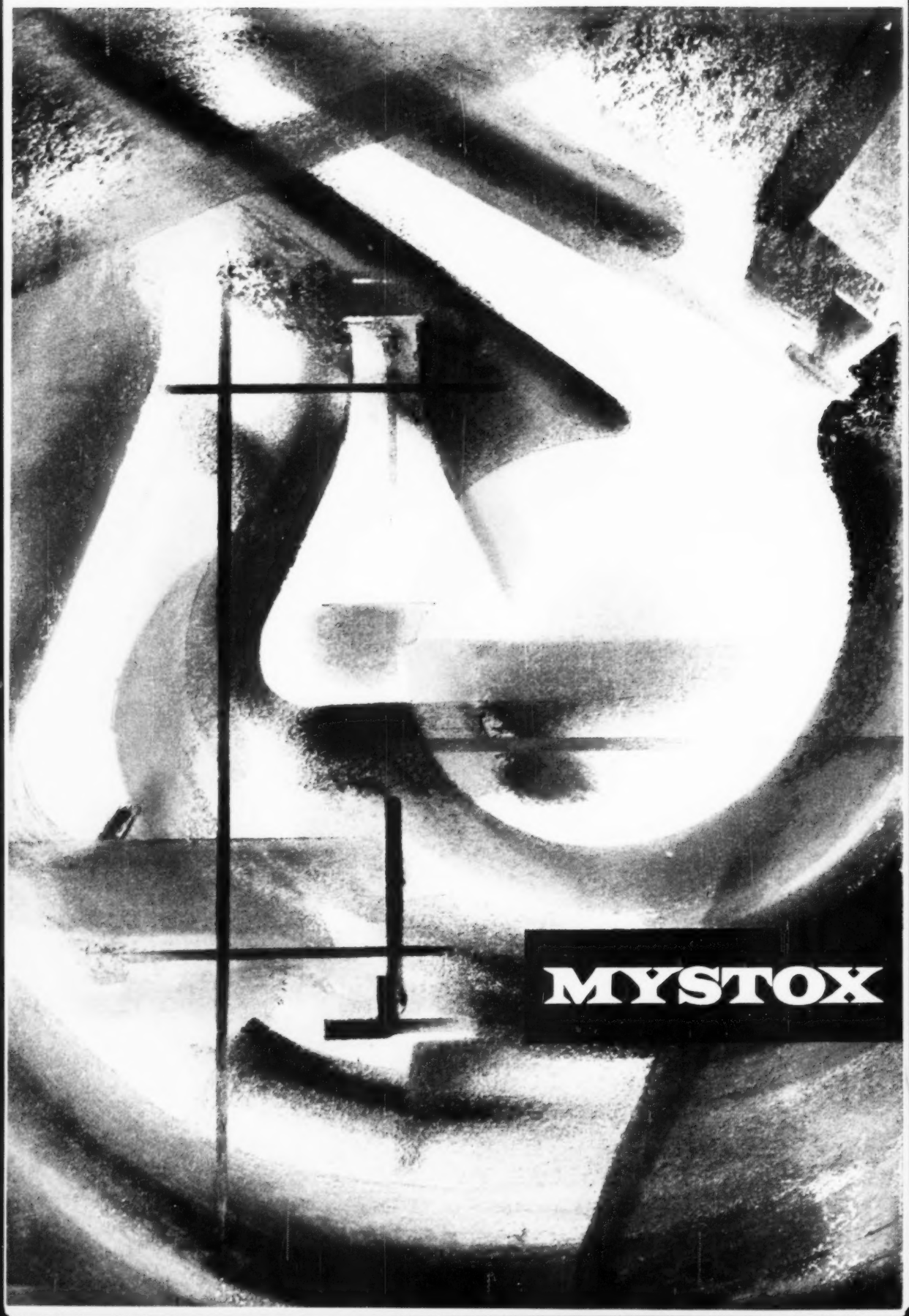
MYSTOX

Research

is a part of our service

THE ANSWER TO YOUR PARTICULAR ROT-PROOFING PROBLEM

Whatever your rot problem—bacteria, fungi, damp, insects—Lauryl Pentachlorphenol is sure to provide an answer. But the most effective concentration, presentation and method of application are all variables. It is part of our service, by specialised research in our Welwyn Garden City laboratories, to provide an answer—and where necessary, to formulate Lauryl Pentachlorphenol specially for you as a MYSTOX presentation.

Lauryl Pentachlorphenol is known to the trade as Mystox LP and Pentachlorphenol as Mystox P. Approved by the Home Office and Ministry of Supply, the Ministry of Agriculture, Fisheries and Food, the Ministry of Works, the National Coal Board and many Government Departments as a fungicide, fungistat and insecticide for a variety of applications.

THE FIRST NAME FOR LAURYL PENTACHLORPHENOL ✳

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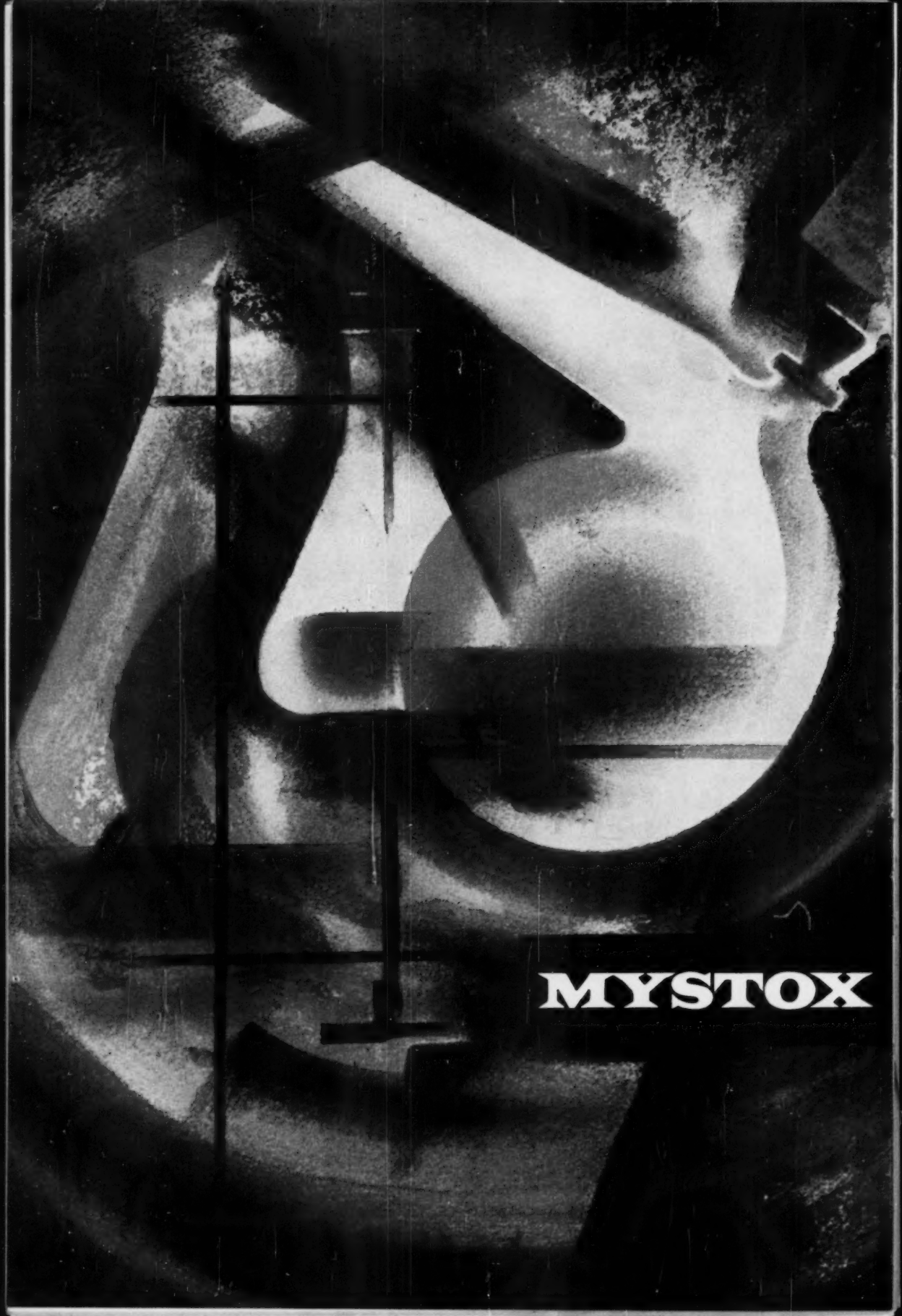
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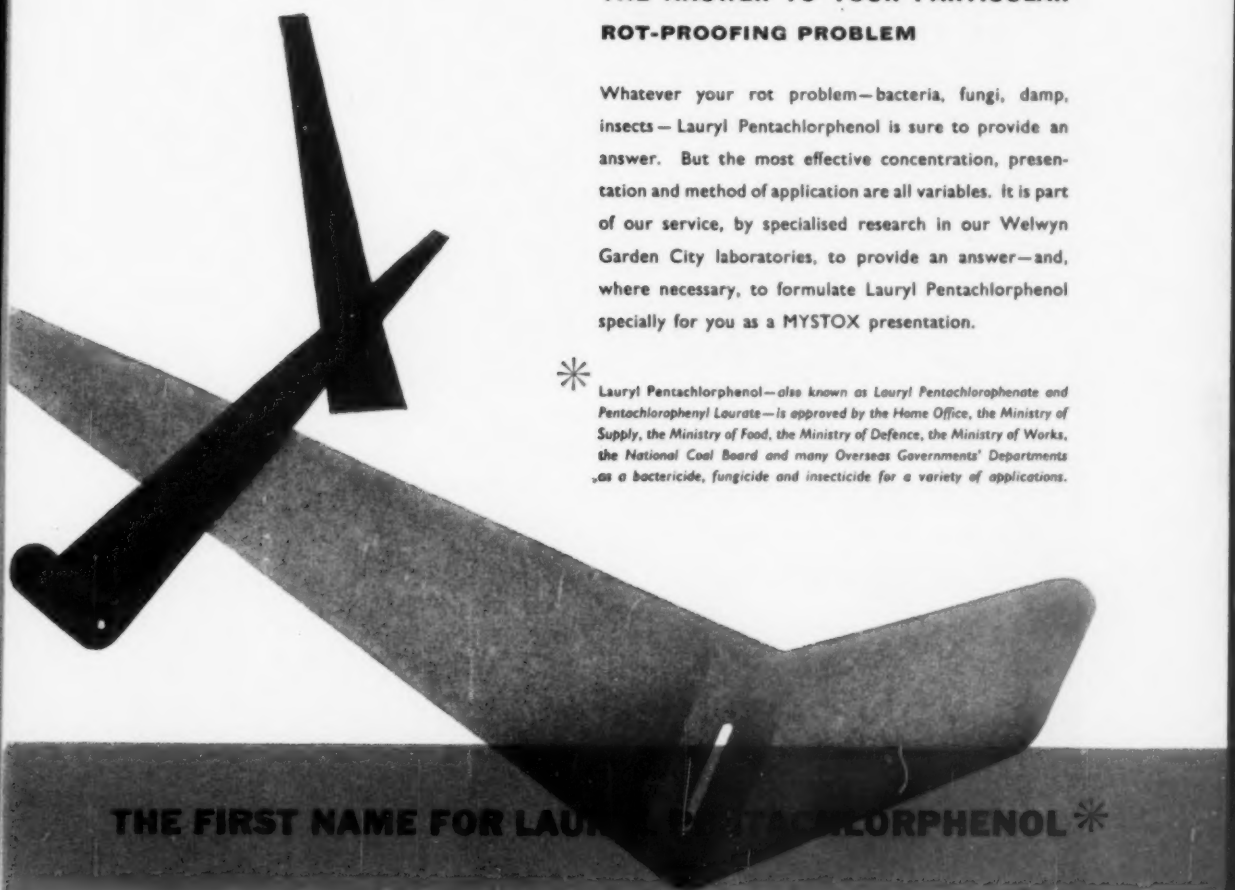

✳ *Lauryl Pentachlorphenol—also known as Lauryl Pentachlorophenate and Pentachlorophenyl Laurate—is approved by the Home Office, the Ministry of Supply, the Ministry of Food, the Ministry of Defence, the Ministry of Works, the National Coal Board and many Overseas Governments' Departments as a bactericide, fungicide and insecticide for a variety of applications.*

THE FIRST NAME FOR LAU[illegible]TACHLORPHENOL ✳

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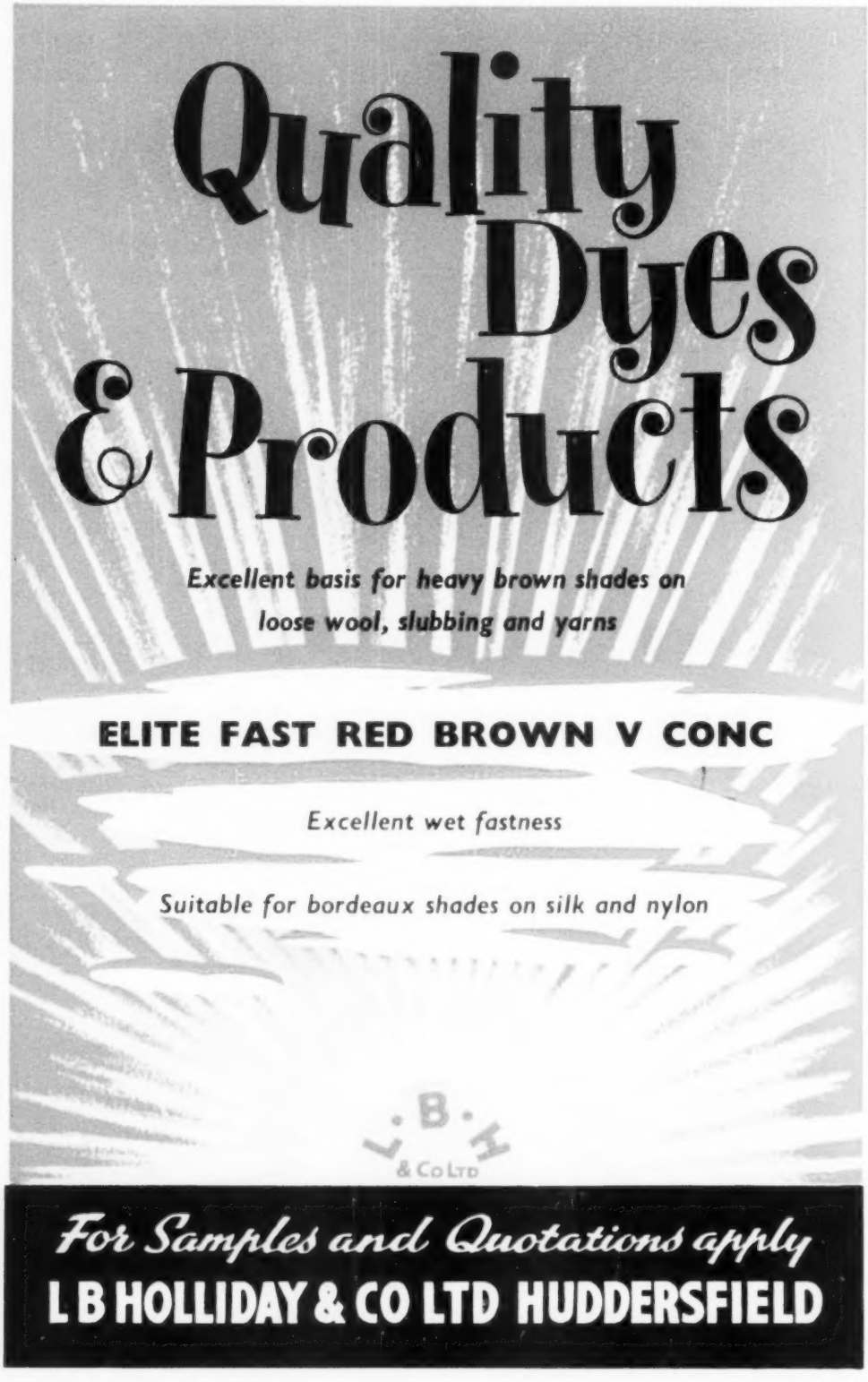
Quality
Dyes
& Products
Excellent basis for heavy brown shades on
loose wool, slubbing and yarns
ELITE FAST RED BROWN V CONC
Excellent wet fastness
Suitable for bordeaux shades on silk and nylon
L·B·H
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L B HOLLIDAY & CO LTD HUDDERSFIELD

Your skill and new

brotasul

produce finer printing

Our new Brotasul is a formaldehyde sulphoxylate compound which has been designed to help you overcome certain difficulties associated with the more traditional sulphoxylates.

For example, there is no "halo" effect when Brotasul is used in the discharge printing of fine filament acetate fabrics. Brotasul offers advantages in the printing of fabrics containing fibres of cellulose acetate, triacetate, nylon, silk and wool. Brotasul has no tendering effect on wool, and it has a very low solubility.

May we tell you more about this new product? Please write to us for full information.

Brotasul by **Brotherton**

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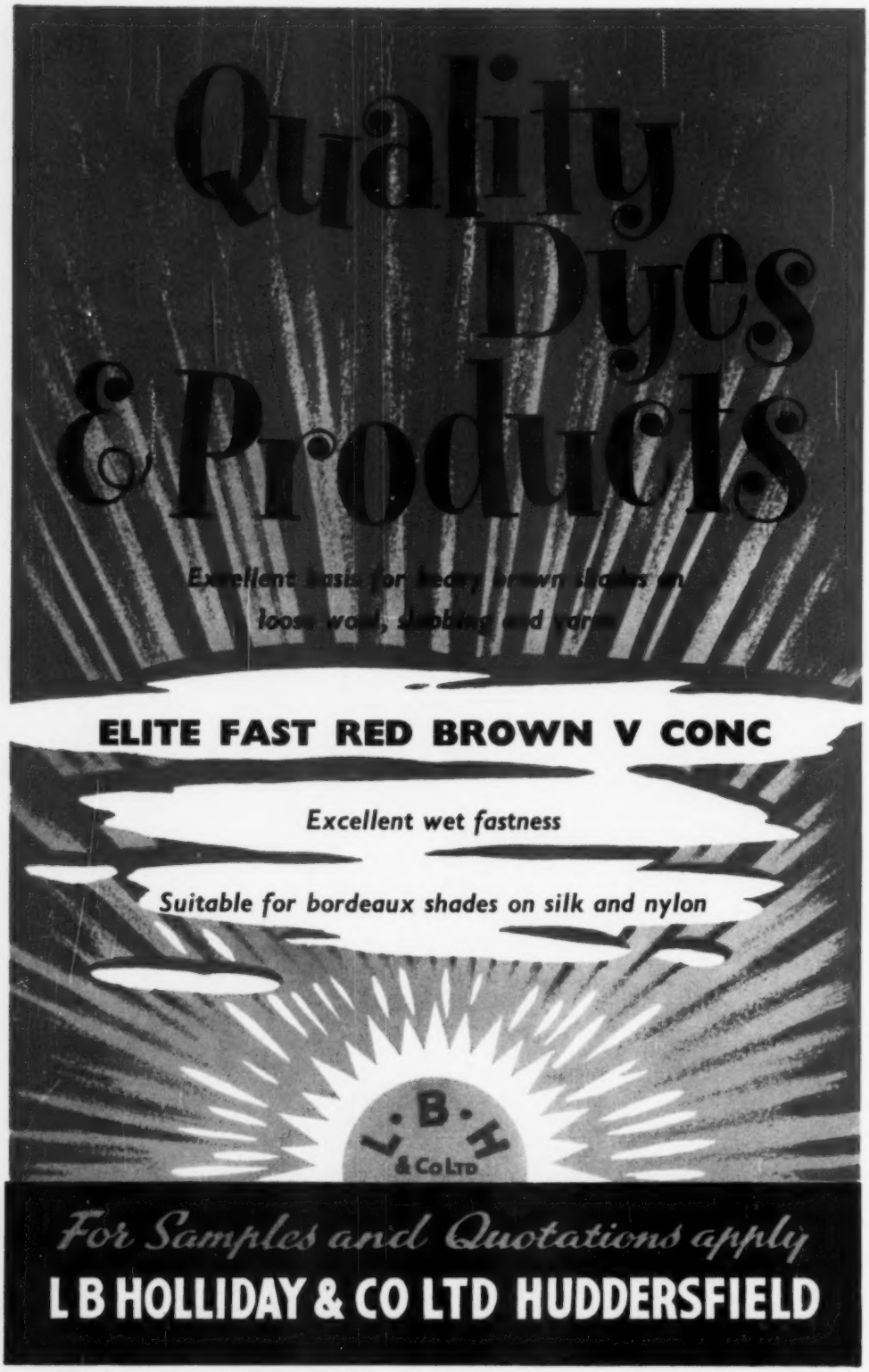
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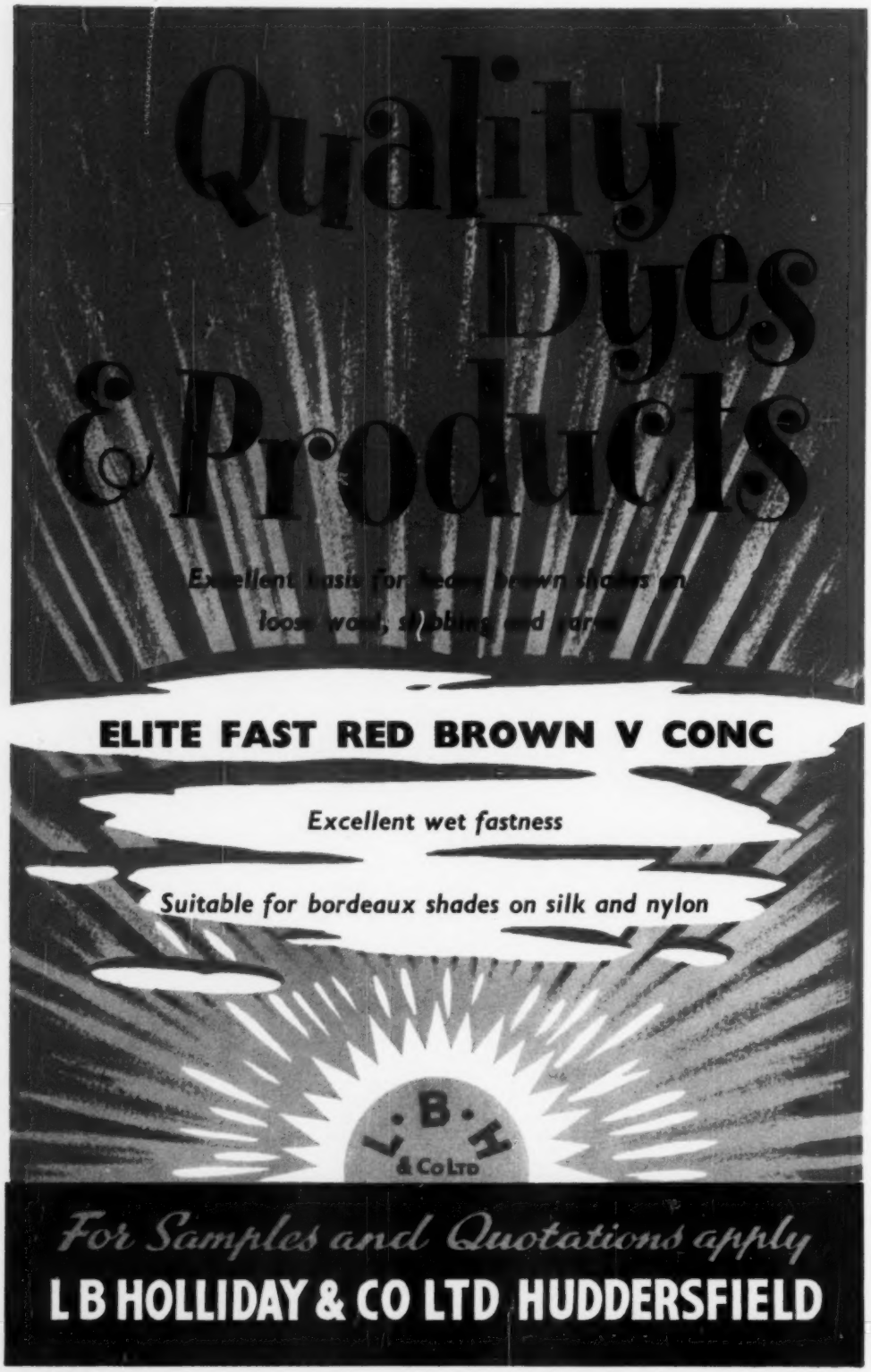
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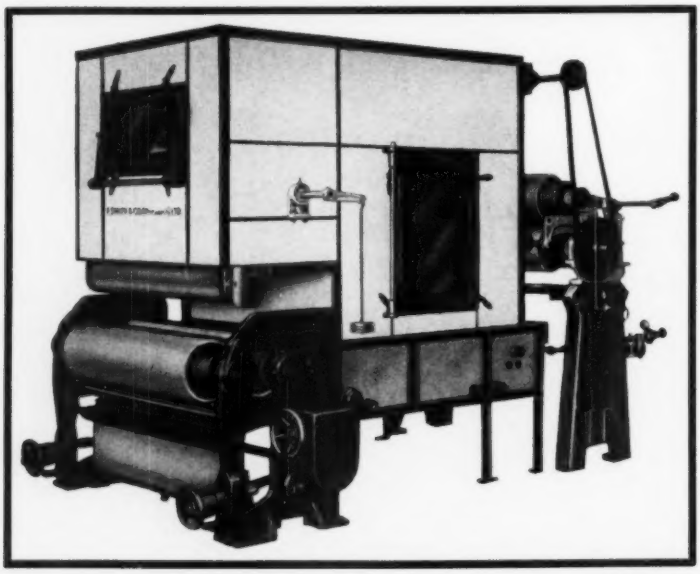

PAD STEAMER

CONTINUOUS DYEING

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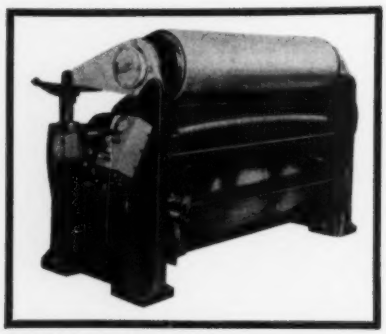
2 SMITHS' PAD STEAM UNIT
3 SMITHS' WASHING RANGE

for vat, sulphur and direct dyestuffs



INCLINED NIP PAD MANGLE

SMITHS' SPECIAL FEATURES ENSURE

Uniformity of treatment
and full automatic control throughout
the process with outstanding economy
in materials, steam and labour

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SUNNYSIDE WORKS WHITWORTH ROCHDALE
Telephone 2233

* *AND THE WELL KNOWN WASHING RANGE . . .*

more man-made fibres

are produced by

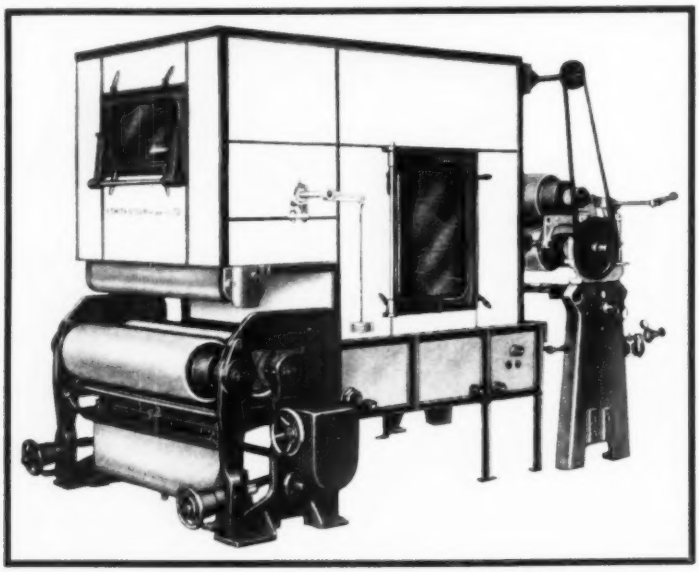
Courtaulds

and their subsidiary
and associated companies

than by any other company in the world

SMA-14

Courtaulds Limited, 16 St. Martin's-le-Grand, London, E.C.1.



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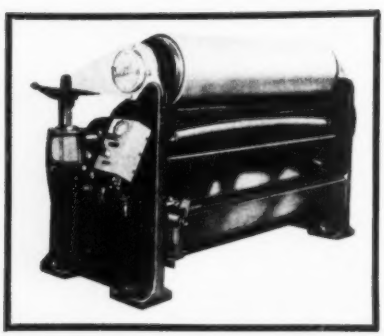

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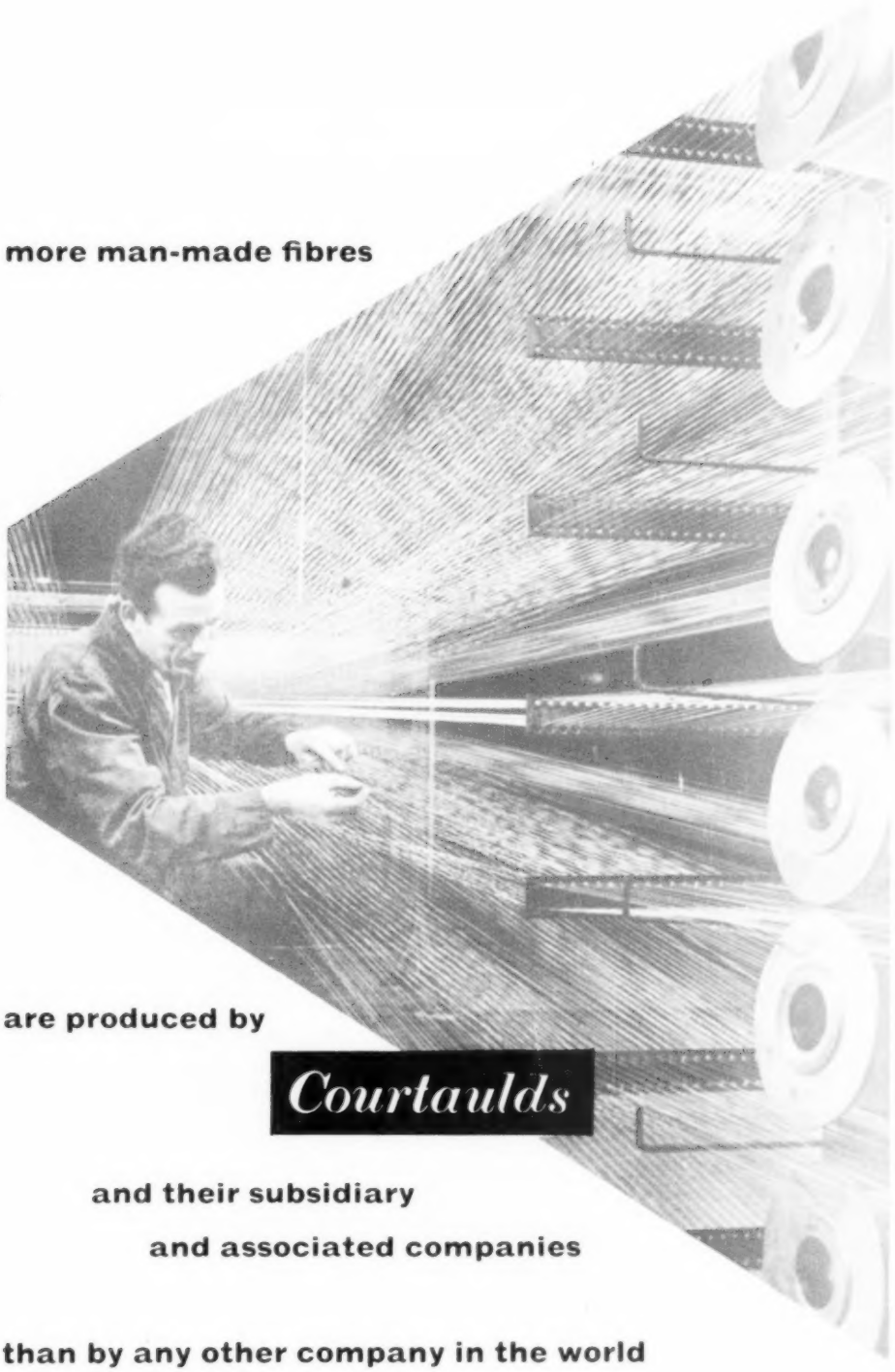

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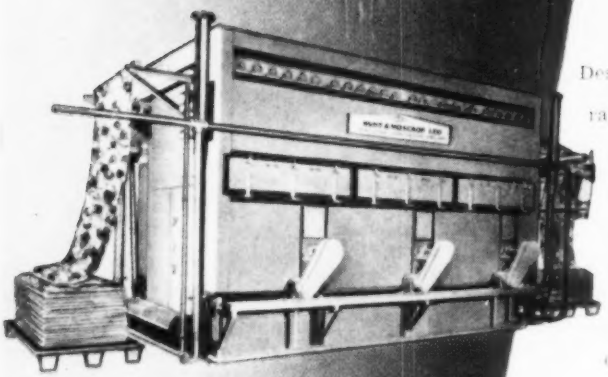
BAKING MACHINES

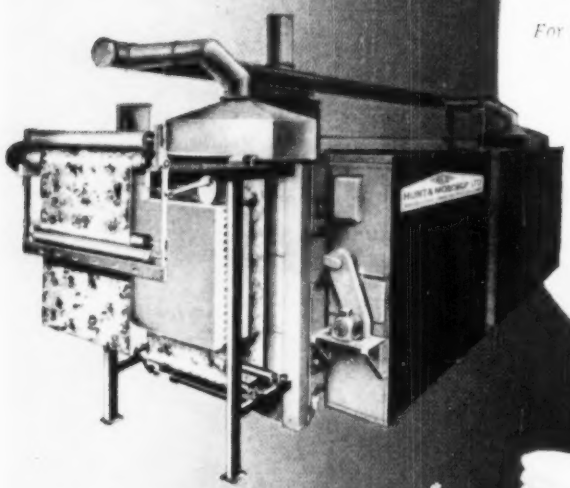
for all Synthetic Resin Finishes



200 yds capacity Roller type machine

Designed to handle the lightest rayons or the heaviest cotton drills, Hunt and Moscrop Baking Machines are designed specifically to meet customers own requirements with capacities up to 400 yds per minute and for temperatures up to 420 F.

For further information please send for leaflet JD/19



240 yds capacity Loop type machine

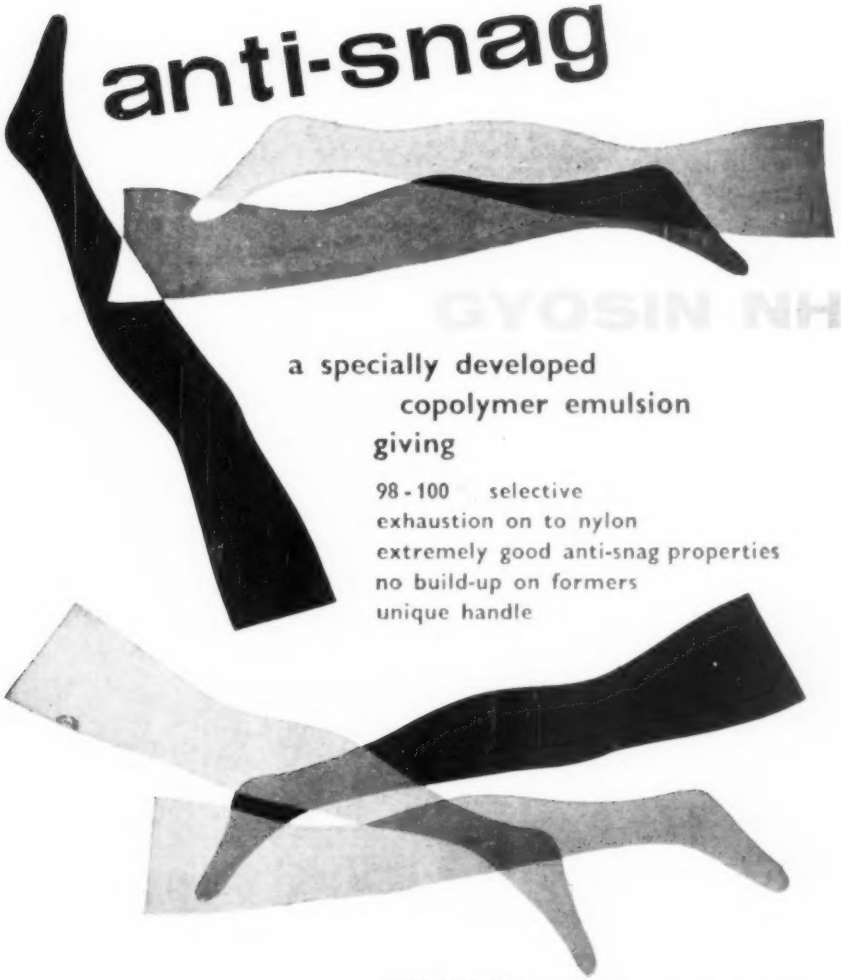
HUNT & MOSCROP LTD

P.O. Box No. 8, Middleton, Manchester · Telephone Middleton 2476-7-8

HM

JD/HM19

anti-snag



GYOSIN NH

a specially developed
copolymer emulsion
giving

98 - 100 selective
exhaustion on to nylon
extremely good anti-snag properties
no build-up on formers
unique handle

GYOSIN NH can also be used for the production of semi-permanent finishes on cotton, nylon, triacetate and other fibres by substantive or pad application.

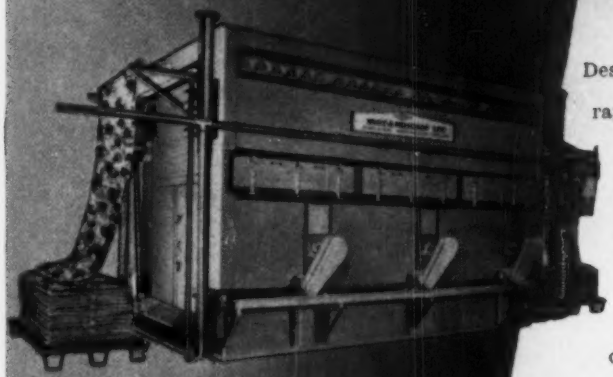
GYOSIN NH can be combined to advantage with U/F and M/F finishes.

The Geigy Company Ltd., Rhodes, Middleton, Manchester.

S.24.

BAKING MACHINES

for all Synthetic Resin Finishes



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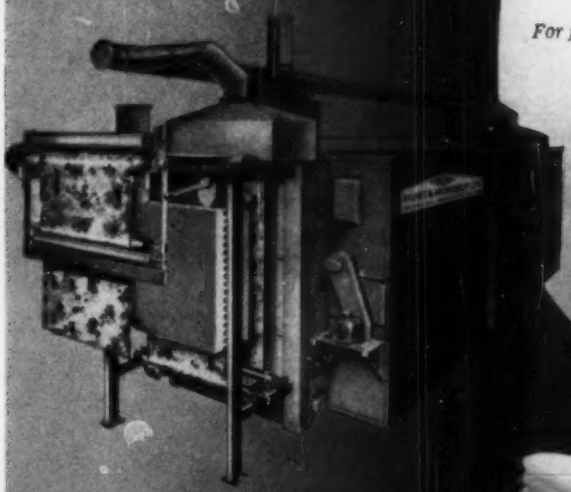

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HM

dm/HM19

anti-snag

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a specially developed copolymer emulsion giving

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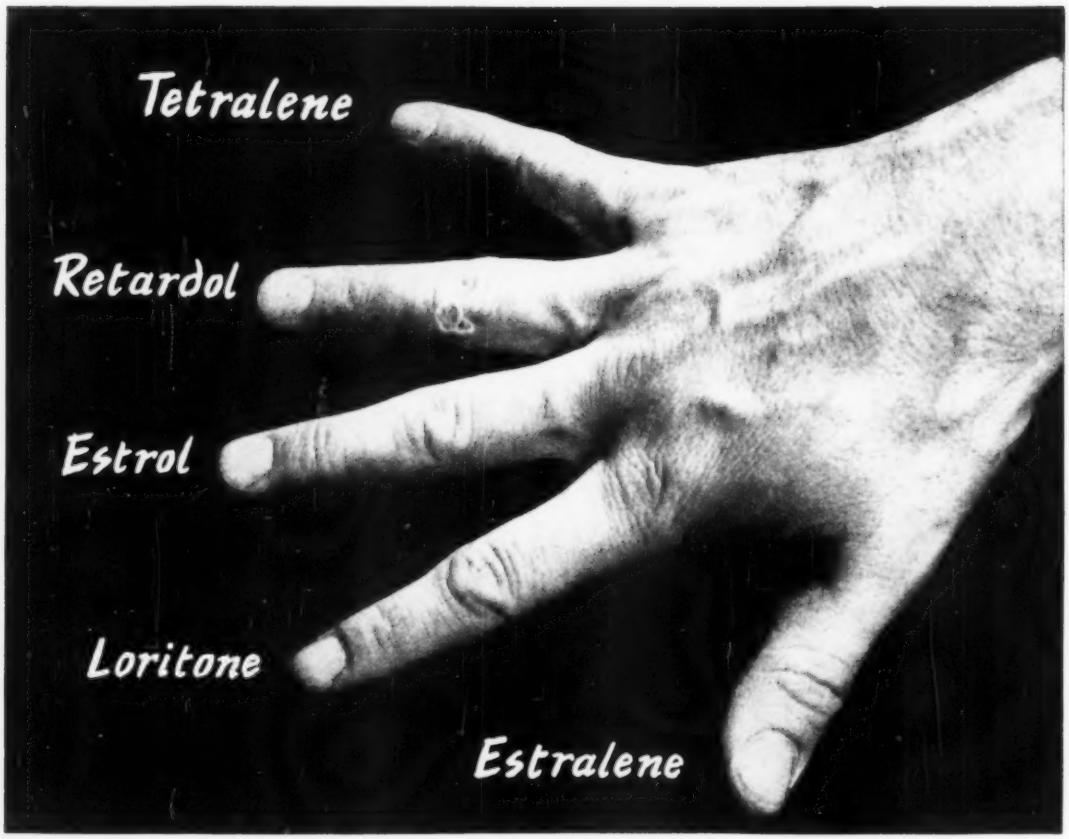
The Geigy Company Ltd., Rhodes, Middleton, Manchester.

S. 24.

The answer to your problem may be at our fingertips

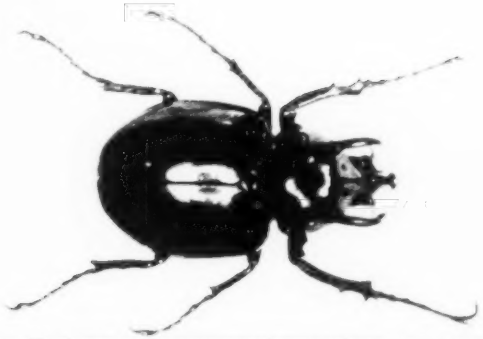


From amongst our wide range of chemicals for textile dyeing, wet processing and finishing, you may find a product which immediately answers *your* particular problem. Specialisation and constant research by "S.U.C." chemists has produced a range of textile auxiliaries which have already been well tried and well proven in the trade. You can be assured of a *consistently* good product from "S.U.C."

STOCKPORT UNITED CHEMICAL CO LTD

A Member of the Associated Chemical Companies Limited Group

CANADA STREET HEAVILEY STOCKPORT Telephone Stepping Hill 2980



Cibalan Blacks
BGL | 2GL | 2BL

for all shades of black in the dyeing and printing of Wool, Silk and Polyamide fibres

Cibalan Black BGL

for the production of slightly reddish blacks

Cibalan Black 2GL

for attractive greenish blacks which also appear greenish in artificial light

Cibalan Black 2BL

is a bloomy, bluish black which retains its shade in artificial light

CIBA

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RANGES OF REPUTATION

DURAMINE and **EVRON FAST**
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AZONINE and **DURANTINE FAST**
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Town End Chemical Works Limited

BRAMLEY · LEEDS 13

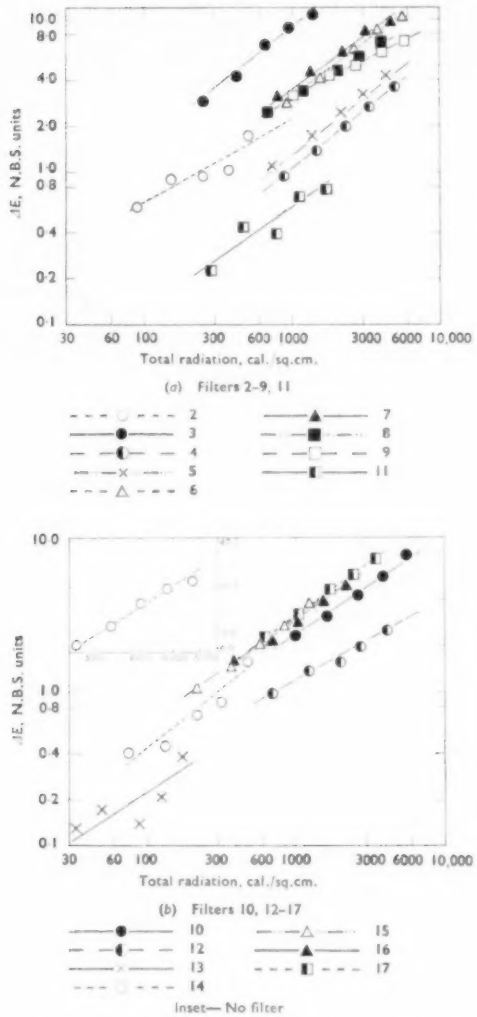

FIG. 5—Logarithmic Plot of Fading of Green Dyed Sample as a function of the Total Radiation transmitted by the Filters

not parallel to one another. For the present sample this is probably due in part to the fact that two fugitive dyes are present. It is interesting to note that filters 13–17 consist of different thicknesses of the same glass, namely Jena neutral filter N 15. Table II shows that the two thicker portions 13, 14 do not transmit appreciably in the ultraviolet. The other three thicknesses 15–17 are seen to produce identical fading, as shown by the near coincidence of the corresponding lines in Fig. 5. This provides a good check on the accuracy of the measurements.

The quantity L (equation (i)) is a measure of the luminous reflectance of the sample, a measures the redness or greenness, and b the blueness or yellowness. For each sample it was found that ΔL or $(L_1 - L_2)$, Δa, Δb did not give the same fractional contributions to ΔE for one filter as they did for another, whereas for different exposures through the same filter they did contribute the same proportional amount. For example, for the green dye and filter 6, Δa, Δb are about equal and ΔL is somewhat larger; whereas for filter 8, ΔL and Δb are of the same order and Δa is negligible. In the colour space, then, the different faded portions of the sample approached the neutral point along different paths. Some relation probably exists between this phenomenon and the fact that the lines in Fig. 4 and 5 are not all parallel.

The scatter of the points about the lines in Fig. 3–5 may derive from a number of sources. In the first place the assumed energy distribution does vary slightly with atmospheric conditions, particularly in the ultraviolet [7], and so could cause errors in the plotting. Such an effect should be most noticeable for filters 3 and 6, but since data for these are quite consistent, it would seem that no significant error arises in this way. The effect of varying humidity and temperature must also be considered. Although these will not cause relative errors, they could result in a general acceleration or deceleration of the fading process. This should in turn cause a set of experimental points (say, for example, the second point for each filter for the red dye) to be too high or too low in the figure. Some such tendency is exhibited on occasion, but not with any consistency. Probably these changes average out over the course of the exposure. It might be well to note here that the red dye was exposed during July and August, the green during August and September, and the blue from September to January. Errors of measurement probably contribute most to the scatter. It was found that on repeat measurements of a sample L, a, b differed by about 0·1–0·2 on the average, so that ΔL, Δa, Δb each involve a possible error of 0·2, say. Using equation (ii) this leads to a possible error in ΔE of about 0·3 N.B.S. unit on the average, regardless of the magnitude of ΔE, so long only as at least two of the differences ΔL, Δa, Δb are of comparable magnitude, which was the case here. Few of the points in Fig. 3–5 deviate from the lines by more than 0·3 N.B.S. unit. This also explains why, on the log–log plots, deviations are greatest for small values of ΔE. When considering the scatter, one should keep in mind that the smallest colour difference which is visually detectable is about one-third of an N.B.S. unit. Thus for the red dye and red filter 9 the maximum fading which occurred was less than one N.B.S. unit, showing that the red wavelengths produced practically no fading, as expected for a red dye.

Since a logarithmic plot of the fading against the radiation produces a straight line, we may write—

$$\Delta E = pW^q \qquad \text{(iii)}$$

where W = radiation energy density. The constants p, q may be determined for each filter and dye from the data in Fig. 3–5. The index q is, of course, just the slope of the lines. Equation (iii) is a more general form of an equation obtained by Barker *et al.*[8, 9] to describe the fading process.

In order to compute the relative efficiencies of the ten wavelength bands of Table II in producing fading, consider first the case of the red sample.

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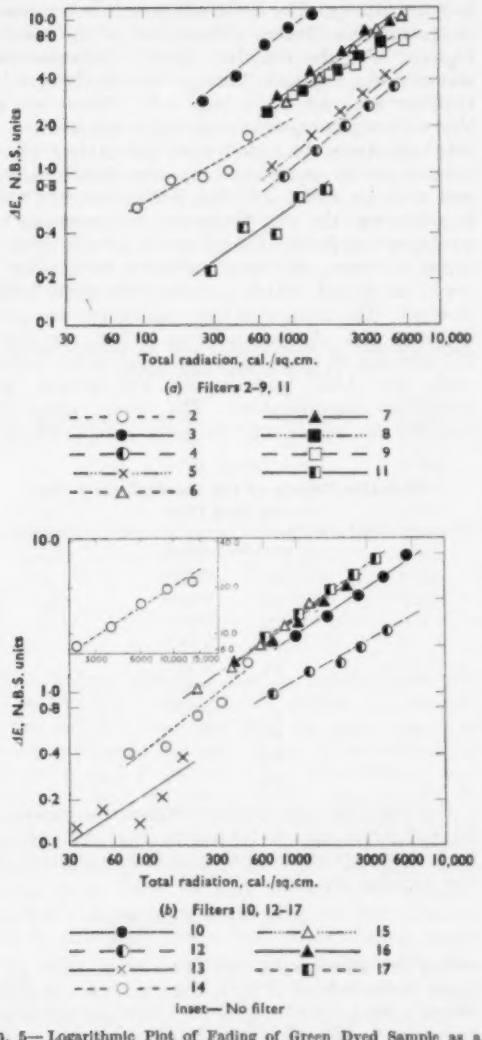

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In order to compute the relative efficiencies of the ten wavelength bands of Table II in producing fading, consider first the case of the red sample.

From Fig. 3 we see that an equation of the form of (iii) holds for each filter. Thus we write*—

$$\Delta E_j = p_j W_j^{q_j} \qquad \text{(iv)}$$

where p_j, q_j are the constants for filter j; ΔE_j = fading produced through filter j; W_j = energy transmitted by filter j. For the red sample in question we find that q_j are all equal, and so (iv) reduces to—

$$\Delta E_j = p_j W_j^{q} \qquad \text{(iv}a\text{)}$$

Since equation (iv$a$) holds for every filter, we may suppose that it also holds for each wavelength band separately: i.e. we assume that a filter which transmitted energy in only one of the ten wavelength bands would also produce fading in accordance with equation (iv$a$). Hence we get—

$$\Delta E_{ij} = p_{ij} W_{ij}^{q} \qquad \text{(v)}$$

where ΔE_{ij} = fading produced by the ith wavelength band of the jth filter; W_{ij} = energy in the ith wavelength band of the jth filter.

Three assumptions are now made—

(i) All wavelengths in band i are equally effective in producing fading. This, of course, is not strictly true, but should be a fair approximation, since the bands are relatively narrow.

(ii) The constants p_{ij} are independent of j. This would seem logical, and the experimental data for the green dye seem to substantiate it, since filters 15–17, which have the same relative transmissions, produce the same values of p_j, as mentioned earlier.

(iii) The fading process is additive: i.e. we would get the same result by exposing the cloth to wavelength band i_1 and then to band i_2 as we would get by exposing to bands i_1 and i_2 simultaneously. The data of McLaren seem to justify this assumption.

We may now write—

$$\Delta E_j = \sum_i \Delta E_{ij} \qquad \text{(vi)}$$

or—

$$p_j W_j^{q} = \sum_i p_i W_{ij}^{q} = \sum_i p_i (t_{ij} W_{i0})^{q}$$

where t_{ij} = transmission of filter j in the ith wavelength band (Table II)†; W_{i0} = energy of sunlight plus skylight in the ith wavelength band (Table I).

Thus we get—

$$p_j = \sum_i p_i (t_{ij} W_{i0} / W_j)^{q} \qquad \text{(vii)}$$

This gives a set of simultaneous equations for the computation of p_i, since all other quantities in (vii) are known. The constants p_i will be a measure of the relative "fading efficiencies" of the spectral regions. For the red dye, filter 9 indicates that wavelengths beyond 700 mμ. are ineffective, so that we may set $p_9 = p_{10} = 0$. Hence we are left with eight equations in eight unknowns. It was unfortunately found that the matrix of the coefficients in equation (vii) was ill-conditioned and that an exact solution led to an oscillating function for the p_i. However, by imposing the auxiliary condition that all p_i be greater than or equal to zero, an approximate solution for p_i could be found which satisfied the data rather closely*. The results of this calculation are given in Table III. As pointed out earlier, the region 300–350 mμ. is responsible for most of the fading, while the blue wavelengths 400–500 mμ. also contribute appreciably. The near ultraviolet 350–400 mμ. apparently has only a slight effect.

TABLE III

Relative Values of the Coefficients p_i for the Red Dye

(The ten wavelength bands are numbered 1–10 starting in the ultraviolet)

p_1	0·700
p_2	0·020
p_3	0·080
p_4	0·080
p_5	0·033
p_6	0·047
p_7	0·027
p_8	0·013
p_9	0
p_{10}	0

For the blue and green samples the various q_j are not equal, and so equations (iv$a$) and (vii) are no longer applicable. Starting from equation (iv) one obtains in place of (vii)—

$$p_j = W_j^{-q_j} \sum_i p_i (t_{ij} W_{i0})^{q_i} \qquad \text{(viii)}$$

where the assumption has been made that $q_{ij} = q_i$ are independent of j. p_i may not be calculated directly from (viii) because the q_i are also unknown. In order to obtain some estimate of the contributions of the various wavelength bands a less exact calculation is made. Although ΔE does not vary linearly with W, the extent of the non-linearity is rather small for large values of W. Hence we write—

$$\Delta E_j = \sum_i s_i t_{ij} W_{i0} \qquad \text{(ix)}$$

where s_i are coefficients expressing the relative efficiencies of the spectral regions. We may solve equation (ix) for s_i by using values of ΔE_j for some particular value of W_0, where W_0 is the total radiation received. Values of s_i for the three dye samples are given in Table IV, the red dye also being considered in order to compare this calculation with the preceding one. Because of the non-linearity and because q_j are different, the values obtained for s_i will depend on which value of W_0 we choose to get ΔE_j. As before, equation (ix) is not solved exactly, but a best fit is obtained

* In order to have an unambiguous and yet easily readable notation, the following will be used: the letter j appearing as a subscript will always refer to a filter; the letter i appearing as a subscript will always refer to a wavelength band. Thus p_j is the constant of filter j; p_i is the constant of wavelength band i; p_{ij} is the constant of the ith wavelength band of filter j.

† The quantities $t_{ij}W_{i0}$ are more accurately given by $\int_{\lambda_1}^{\lambda_2} W_\lambda t_\lambda j\mathrm{d}\lambda$ and were in fact computed in this way.

* A large number of the coefficients in equation (vii) are zero, and so the difficulties of calculation are considerably lessened.

subject to the condition $s_i \geqslant 0$. For the red and blue samples s_9 and s_{10} were set equal to zero, and hence equation (ix) gave eight equations in eight unknowns. For the green sample s_{10} was made zero (see curve for filter 11, Fig. 5), and filters 2–10 were used to solve nine equations in nine unknowns. Using the values of s_i given in Table IV, the observed and computed values of ΔE_j agree in general to within about 10%. In the case of the green dye the values of s_i also give just as good results for filters 11–17, although the fading computed for no filter is much greater than is actually observed.

TABLE IV

Relative Values of the Coefficients s_i for the Red, Blue, and Green Dyes

	Red	Blue	Green
W_0, cal./sq.cm. ...	3,000	10,000	9,000
s_1	0·700	0·732	0·585
s_2	0·009	0·005	0·003
s_3	0·139	0·126	0·069
s_4	0·005	0·000$_5$	0·004
s_5	0·093	0·005	0·056
s_6	0·009	0·025	0·099
s_7	0·037	0·101	0·040
s_8	0·007	0·005	0·139
s_9	0	0	0·004
s_{10}	0	0	0

The values obtained for s_i substantiate the qualitative observations made earlier. In the case of the red dye one sees that the same trend is shown by p_i and s_i, although the p_i indicate that the regions 2 and 4 (350–400 and 450–500 mμ. respectively) have a greater effect than would be found from s_i alone. For the green sample the red band 650–700 mμ. is seen to produce considerable fading, although beyond this little occurs. One notices from Table IV that for all three samples the bands 2 and 4 seem to produce little fading. This is probably not a real effect, but is more likely due to the approximate nature of the calculation, and to the uncertainties in energy distribution, which may be rather large in the ultraviolet. Comparing Table IV with Fig. 1, one notices that smaller values of s_i are obtained for those regions where the reflectance is highest, as is to be expected.

In comparing the results obtained by this method with those of McLaren [3] it must be borne in mind that the quantities p_i and s_i describe the relative fading per unit energy in each wavelength band, whereas the quantities calculated by McLaren give the fading for particular bands of daylight.

Equation (iii) may be compared with other equations which have been used to describe the fading process. Barker, Hirst, and Lambert [8] found that—

$$L = ct^{\frac{1}{2}} \qquad \text{(x)}$$

where L = percentage loss of predominant colour; t = time of exposure in hours; and c is a constant. Equation (x) may be considered a special case of (iii). It would seem more fundamental, however, to use the radiation W as in (iii) rather than the time as in (x). For the dyes used here the quantity q in (iii) has the values 0·8, 0·5–0·9, 0·5–0·8 for the red, blue, and green samples respectively.

The equations—

$$F = mt^{\frac{1}{2}} + k \qquad \text{(xi)}$$

and—

$$F = a \log t + b \qquad \text{(xii)}$$

where F is the fading and m, k, a, b are constants, have also been proposed [10, 11]. Equation (xi) would seem to be the same as (x), since for $t = 0$ we get $F = 0$, and so k must be zero. An equation of the type (xii) would not fit the present data.

Cunliffe and Lambert [10] suggest that the fundamental equation may be of the form—

$$F_t = F_\infty (1 - e^{-kt}) \qquad \text{(xiii)}$$

where F_t is the fading after time t, F_∞ is the limiting value of fading, and k is a constant. However, the data presented here indicate that the fundamental equation is not a simple exponential as in (xiii). If one attempts to fit an equation such as (xiii) (with W replacing t) to the present data with F_∞ and k treated as parameters, the calculated curve does not represent the observed points nearly as well as (iii). More important, however, is the fact that one obtains a different value of F_∞ for every filter, and F_∞ for one filter is often smaller than some already observed values of F_t for other filters. If F_∞ is to be the limiting value of fading, then it should be the same, independent of which particular wavelengths cause the fading. In fact, F_∞ should represent the colour difference between the sample before fading and the undyed material. It has also been shown that the rate of fading is dependent on the physical state of the dye [12] and upon the substrate [13], so that a single equation to represent fading over the complete range probably cannot be written in terms of common analytic functions. It is somewhat surprising that the empirical equation (iii) holds over such a wide range (23 N.B.S. units in the case of the green dye with no filter).

CONCLUSIONS

The method outlined here for calculating the spectral dependence of fading has met with only limited success. A series of filters which cut sharply at both ends of the pass bands would be extremely useful, since an ill-conditioned matrix would no longer be obtained, and at the same time the solution of the equations would be made relatively simple. The experiment could be better performed using a controlled source of known spectral energy distribution under controlled conditions of humidity and temperature. A xenon lamp such as that described by Mudd [14] would be well suited to the experiment. The only fundamental difficulty of the method would seem to be the determination of q_i in equation (viii). Presumably these could be estimated from q_j, however, especially if the filters had relatively narrow pass bands. A more detailed investigation of the assumption of additivity might also be in order. Once the coefficients p_i are accurately known for a dye, the fastness of the dye under any energy distribution may be calculated.

The problem of preventing fading in shop windows is a complex one. A deep red filter would

protect most dyeings, but would probably be objectionable for other reasons. The amber shades commonly in use are perhaps as good a choice as any, since ultraviolet, violet, blue, and green radiations are excluded.

Since the completion of this study, the AATCC Committee on Colorfastness to Light has reported a wealth of detail in support of using the total radiation rather than the time to measure the fading process[15]. The consistency of the present experimental data further points out this advantage.

* * *

The author wishes to thank Dr. W. E. K. Middleton for suggesting the study and for helpful discussions. He is indebted to members of the Division of Building Research, National Research Council, for supplying him with daily records of the total radiation. Miss A. S. Tweedie generously supplied the samples.

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Canada

(*Received 14th July 1958*)

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CORRESPONDENCE

The Editor does not hold himself responsible for opinions expressed by correspondents

Spacing of the Blue Light-fastness Standards

Some time ago McLaren[1] published a very interesting study of the spectral regions of daylight which cause fading. On p. 97 of this paper a graph (Fig. 8) is shown which seems to prove that the spacing of the blue standards depends in the first instance on the spectral composition of the light used for the exposure. Some observations of ours, however, contradict this straightforward explanation of the differences in spacing.

A series of blue standards was exposed to Northern daylight, to direct sunlight, and in the C.P.A. fading lamp, the Fugitometer, the Fade-Ometer, and the Xenotest. The exposure times were so chosen as to give on the average the same amount of fading on standards 4, 5, and 6. The increase in reflectance was then measured with a tristimulus reflectometer, using the amber filter. The results are shown in Fig. 1.

These results show clearly that the spacing of the standards 1–3 is not primarily dependent on the spectral composition of the light used for the exposure, the spacing being not systematically different for carbon arc lamps in comparison with natural illumination. On the other hand, the spacing shows a big spread for either illuminant.

It is now generally accepted[2] that the following factors influence fading—(1) the spectral composition of the light, (2) the moisture content during exposure, and (3) the temperature during exposure. It is also generally believed that the main influence of factors 2 and 3 is a combined effect on the actual humidity of the sample, which is expressed in the definition of the "effective humidity"[3].

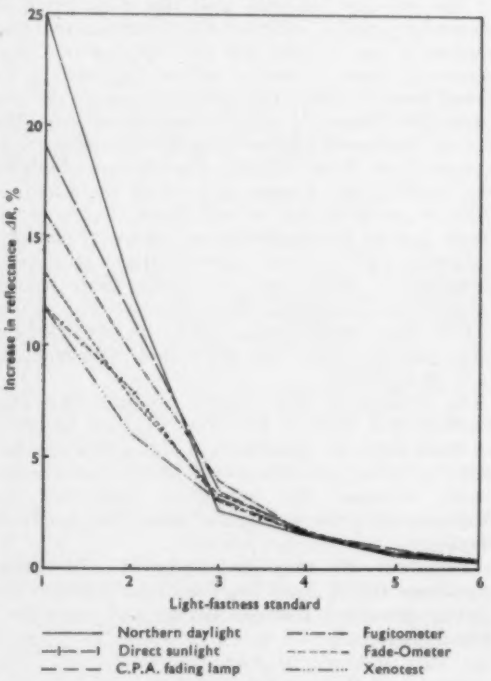

FIG. 1

It has been verified[3] that the fading of the blue standards is not affected by variations in humidity. This was confirmed by us in comparing exposure results for a wet and a dry C.P.A. lamp, and a wet and a dry Fade-Ometer. It will therefore not be

possible to explain the spacing differences by spectral differences or differences in effective humidity. Of the three factors mentioned, perhaps the temperature could be responsible for the spacing differences. This assumption seems to be reasonable, as the fading, being a photochemical reaction, will show a temperature effect on the reaction rate. The temperature dependence could be different for different samples. Although there are indications[4] in this direction, McLaren[3] states that no temperature effects on the spacing of standards have been observed. This was confirmed by our observations, running Fade-Ometer exposures at different temperatures.

A fourth factor causing anomalies in fading could be non-proportionality between fading rate and light intensity. Although it is doubtful whether there is much experimental evidence for this effect[5], it must be admitted that the observed spacing decrease is in line with an increase in light intensity.

A better understanding of fading (and degradation) processes is still needed to arrive at a full explanation of the variable results of exposure tests.

L. F. C. Friele

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Netherlands

30th October 1958

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Notes

Meetings of Council and Committees December 1958

Council— 3rd

Finance and General Purposes— 17th

Publications— 16th

Colour Index Editorial Board— 16th

International Federation 1959 Congress—
Scientific and Technical Subcommittee— 19th
Ladies' Subcommittee— 12th

Deaths

We regret to report the loss by death of Mr. H. Ashworth, Mr. E. Hargrave, and Mr. W. E. Stewart.

Income Tax and Membership Subscriptions

Section 16 of the Finance Act, 1958, provides that, commencing with the year to 5th April 1959, an employed person or the holder of an office may be given income tax relief in respect of the following—

(1) An annual fee or contribution which he is required to pay as a statutory condition of exercising his profession

(2) An annual subscription paid to a professional body, learned society, etc., which has been approved by the Commissioners of Inland Revenue under Section 16, provided that the activities of the society are relevant to the office or employment.

The Commissioners of Inland Revenue have approved the Society of Dyers and Colourists for the purposes of Section 16, and a member who thinks himself entitled to this relief should apply to his local tax office for Form P 358, on which to make a claim for adjustment of his pay-as-you-earn coding.

A.S.D.C. and Burnham Scales

The Society has been informed that the Associateship (by examination) has been accepted as a degree equivalent for the purposes of the Burnham Main and Technical Reports. This means that an Associate who is engaged in teaching is now entitled to receive the graduate increment in salary appropriate to the post he occupies.

A.S.D.C. Examination 1959

The annual examination for the Associateship of the Society of Dyers and Colourists will be held on Thursday, Friday, and Saturday, 4th, 5th, and 6th June 1959. Candidates should note that Papers A and B may be taken together, followed by C, D, and either E(i) or E(ii); or Papers A, B, and C may be taken together, followed by D and either E(i) or E(ii). Candidates should indicate the special branch of tinctorial technology in which they desire to be examined and state whether they intend to take the examination in one or two stages and which of the two Papers E(i) or E(ii) they will take.

Application forms are obtainable from the offices of the Society and must be completed and returned not later than Saturday, 28th February 1959.

President of the I.F.A.T.C.C.

At the annual meeting of the Council of Delegates of the International Federation of Associations of Textile Chemists and Colourists, held in Milan on 9th December 1958, Mr. John Boulton (President of the Society of Dyers and Colourists) was elected President of the Federation for the ensuing three years. Dr. H. Ris was Vice-president. Herren P. Deck and M. Peter (Switzerland) were re-elected treasurer and secretary respectively for a further year.

The retiring president of the International Federation, Dr. Luigi Sessa, has been made a "Cavaliere del Lavoro" on the order of the President of the Republic of Italy, in recognition of his work in dyeing, chemistry, and agriculture.

City and Guilds of London Institute

On 1st December 1958 the Institute moved to its new headquarters at 76 Portland Place, London W.1 (*Telephone* LANgham 3050).

John Barritt, O.B.E.

Members of the Society will wish to congratulate Mr. J. Barritt, B.Sc., A.R.C.S., A.R.I.C., F.S.D.C., on his appointment as an Officer of the Most Excellent Order of the British Empire, announced in the New Year Honours List. Mr. Barritt, who is Deputy Director of Research of the Wool Industries Research Association, has played a prominent part in the affairs of the Society: he was Honorary Secretary from 1946 to 1953, and was made an Honorary Member. He has also served as Chairman of the Publications Committee, and last year received the Society's gold medal for exceptional services as Chairman of the *Colour Index* Editorial Panel.

Walter Robert Moore, M.B.E.

Members of the Society will wish to congratulate Mr. W. R. Moore, Ph.D., F.R.I.C., on his appointment as a Member of the Most Excellent Order of the British Empire, announced in the New Year Honours List. Dr. Moore, who is Reader in High-polymer Chemistry at the Bradford Institute of Technology, has served the Society in several ways: he has been an abstractor for the *Journal* for some five years, has reviewed books on high polymers, and took a leading part in organising and running the Summer School held at Nottingham in August 1958.

Jean-Paul Sisley (1902–1958)

The issue of *Teintex* for October 1958 announces the sudden death of J.-P. Sisley, general secretary of our French sister society, the Association des Chimistes de l'Industrie Textile, a position that he had held since 1940. He was born in Lyons, where his father, Paul Sisley, was prominent in the dyeing industry, and studied at the École de Chimie Industrielle under Grignard and others during 1919–1922. He entered the research laboratory of the Société des Matières Colorantes de Saint-Denis in 1925, and later acquired his special interest in auxiliary products. In 1943 he was appointed Directeur Général de l'Institut des Corps Gras, and subsequently founded the *Revue Française des Corps Gras*. At the time of his death he was working on the third volume of his *Index des Huiles sulfonées et Détergentes modernes*.

Technical Education in France

The Fédération Nationale des Syndicats Patronaux de la Branche Teinture et Apprêts has been conducting an enquiry into French facilities for education in textile finishing (including bleaching, dyeing, and printing). It has sent questionnaires to the various technical colleges in France, and the August 1958 issue (No. 47) of *Teinture et Apprêts* is devoted to "La Formation Professionnelle". With regard to the training of technologists, replies from fourteen colleges are given (at Lille, Lyons, Mulhouse, Nancy, Paris, Roubaix, Rouen, Strasbourg, and Toulouse), and it is mentioned that one of them gives instruction sometimes on Saturdays and Sunday mornings. The geographical and other difficulties of part-time study are discussed.

Information on provisions for the training of workers and foremen was sought from local employers' associations, and replies were received from Epinal, Lille, Lyons, Mulhouse, Rheims, Roubaix–Tourcoing, Rouen, and Saint-Etienne.

National Lending Library for Science and Technology

The Department of Scientific and Industrial Research will take over part of the former Royal Ordnance Factory at Thorp Arch, near Boston Spa, Yorkshire, for the use of the new National Lending Library for Science and Technology. Present proposals indicate that the library will begin operating at Thorp Arch in 1961.

The new library— the nucleus of which already exists in the D.S.I.R. Lending Library Unit now at Chester Terrace, Regents Park, London— will cover all subjects in science and technology, except for some fields of medicine. It will take over the responsibility for the lending service now provided by the Science Museum Library, which in future will concentrate on serving the needs of the enlarged Imperial College of Science and Technology. It is also taking over some of the literature now held by the Science Museum Library.

The present Lending Library Unit has been collecting literature for the National Library since 1957. It already operates a loan service for Russian literature, which is being progressively extended to cover publications from other countries. Eventually, much of the scientific and technological literature in the world will be included in this collection, to make it the most comprehensive of its kind in the United Kingdom.

The new library in Yorkshire will make its unique collection available to research, industrial, educational, and other organisations by loans and photographic reproduction. Its primary objective will be to encourage the greater use of scientific and technical literature. One important activity will be the expansion of work on the translation of Russian scientific literature, now organised by the Lending Library Unit in collaboration with the National Science Foundation in the U.S.A.

Research Essay Prizes

First prize in the Waverley Gold Medal essay competition, organised by the scientific advisory board of *Research* and Butterworths Scientific Publications, has been won by Mr. A. J. C. Hall and Mr. J. G. Hayes of the Defence Standards Laboratories, Maribyrnong, Australia, for their essay *Coloured Patterns in Glass*. This essay (published in *Research* for December 1958) describes a new patented process which consists of three stages— formation of a metallic pattern on the glass surface, formation of an ionic pattern (latent image) in the glass, and reduction of the latent image to visible form.

COLOUR INDEX

Additions and Amendments

Number 2* January 1959

In conformity with the policy stated in the preamble to the *Colour Index* it is intended to publish in the January, April, July, and October issues of the *Journal of the Society of Dyers and Colourists* and simultaneously in the *American Dyestuff Reporter* a list of additions and amendments to the Second Edition of the *Colour Index* which have been notified to the Society or the American Association of Textile Chemists and Colorists during the previous three months.

Subscribers can obtain these lists printed on one side of the paper only. For further details apply to the General Secretary, The Society of Dyers and Colourists, Dean House, 19 Piccadilly, Bradford 1, Yorkshire, England.

VOLUME 1

Additional *Colour Index* Designations and Numbers

Page
1305

C.I. 18058 Monoazo **C.I. Acid Blue 174**

Acid Blue B ... ... Pol

Amendments

Page	*Colour Index Designation*			
1008	**C.I. Acid Yellow 11**	*add*	**Egacid Yellow G ... ... Chem**
1011	**C.I. Acid Yellow 18**	*add*	**Fast Acid Yellow 2G ... ... Pol**
1013	**C.I. Acid Yellow 23**	*add*	**Tartrazine O ... ... Chem**
1014	**C.I. Acid Yellow 25**	*add*	**Midlon Yellow R ... ... Chem**
1019	**C.I. Acid Yellow 36**	*add*	**Metanile Yellow O ... ... Chem**
1022	**C.I. Acid Yellow 42**	*add*	**Midlon Yellow PR ... ... Chem**
1056	**C.I. Acid Orange 7**	*add*	**Orange II ... ... Chem**
1057	**C.I. Acid Orange 8**	*add*	**Orange RO ... ... Chem**
1058	**C.I. Acid Orange 10**	*add*	**Egacid Orange GG ... ... Chem**
1062	**C.I. Acid Orange 19**	*add*	**Midlon Red GG ... ... Chem**
1073	**C.I. Acid Orange 45**	*add*	**Midlon Orange PR ... ... Chem**
1091	**C.I. Acid Red 1**	*add*	**Egacid Red G ... ... Chem**
1097	**C.I. Acid Red 14**	*add*	**Chromotrop FB ... ... Chem**
1103	**C.I. Acid Red 27**	*add*	**Victoria Rubine O ... ... Chem**
1107	**C.I. Acid Red 35**	*add*	**Midlon Red 3B ... ... Chem**
1117	**C.I. Acid Red 57**	*for*	**Kiton Fast Rubine 3G ... ... Ciba**
		read	**Kiton Fast Red 3GP ... ... Ciba**
1123	**C.I. Acid Red 73**	*add*	**Brilliant Croceine MOOL ... ... Chem**
1126	**C.I. Acid Red 81**	*add*	**Alizarine Rubine GW ... ... Acna**
1128	**C.I. Acid Red 85**	*add*	**Midlon Red PG ... ... Chem**
1130	**C.I. Acid Red 88**	*add*	**Fast Red A ... ... Chem**
1134	**C.I. Acid Red 97**	*add*	**Alizarine Chrome Red G ... ... Chem**
1191	**C.I. Acid Violet 1**	*add*	**Acid Fast Violet L ... ... Chem**
1194	**C.I. Acid Violet 7**	*add*	**Egacid Red 6B ... ... Chem**
1211	**C.I. Acid Violet 43**	*add*	**Alizarine Violanol R ... ... Chem**
1229	**C.I. Acid Blue 1**	*add*	**Carmine Blue VF ... ... Acna**
1232	**C.I. Acid Blue 7**	*add*	**Carmine Blue AF ... ... Acna**
1241	**C.I. Acid Blue 27**	*add*	**Alizarine Turquoise Blue B ... ... Chem**
1246	**C.I. Acid Blue 40**	*add*	**Alizarine Azurol A2G ... ... Chem**

* The first list was published in October 1958.

Page	*Colour Index Designation*			
1248	C.I. Acid Blue 43	*add*	Alizarine Azurol SE	Chem
1250	C.I. Acid Blue 47	*add*	Alizarine Deep Blue R	Chem
1264	C.I. Acid Blue 78	*add*	Alizarine Pure Blue B	Chem
1271	C.I. Acid Blue 92	*add*	Wool Fast Blue R	Chem
1280	C.I. Acid Blue 113	*add*	Wool Fast Blue 5R	Chem
1283	C.I. Acid Blue 120	*add*	Wool Fast Blue GR	Chem
1293	C.I. Acid Blue 145	*add*	Alizarine Azurol ASR	Chem
1316	C.I. Acid Green 20	*add*	Acid Black HG	Chem
		add	Naphthol Green Black B	S
1318	C.I. Acid Green 25	*add*	Alizarine Brilliant Green G	Chem
1324	C.I. Acid Green 41	*add*	Alizarine Brilliant Green 5G	Chem
1329	C.I. Acid Brown 2	*add*	Midlon Brown R	Chem
1353	C.I. Acid Brown 75	*add*	Koranil Brown ER	Chem
1354	C.I. Acid Brown 83	*add*	Koranil Brown CGG	Chem
1355	C.I. Acid Brown 88	*add*	Koranil Brown ITF	Chem
1375	C.I. Acid Black 1	*add*	Acid Black 10B	Chem
1376	C.I. Acid Black 2	*add*	Nigrosine WL Water Soluble	Chem
1384	C.I. Acid Black 24	*add*	Midlon Black P2B	Chem
1385	C.I. Acid Black 26	*add*	Wool Fast Black VL	Chem
	C.I. Acid Black 26A	*add*	Wool Fast Black 4B	Chem
1393	C.I. Acid Black 48	*add*	Alizarine Fast Acid Grey BBLW ...	Chem
1395	C.I. Acid Black 52	*add*	Printing Black for Silk BW	Chem
1403	C.I. Acid Black 84	*add*	Stenile Grey GC	Acna
1408	C.I. Mordant Yellow 3	*add*	Alizarine Chrome Yellow BN	Chem
1410	C.I. Mordant Yellow 8	*add*	Alizarine Chrome Fast Yellow R ...	Chem
1419	C.I. Mordant Yellow 26	*add*	Chromocitronine R	Pol
1433	C.I. Mordant Orange 1	*add*	Alizarine Chrome Orange G	Chem
1436	C.I. Mordant Orange 6	*add*	Alizarine Chrome Orange GR	Chem
1453	C.I. Mordant Red 5	*add*	Alizarine Chrome Garnet R	Chem
1455	C.I. Mordant Red 9	*add*	Alizarine Chrome Red BG	Chem
1507	C.I. Mordant Blue 9	*add*	Alizarine Chrome Blue RR	Chem
1509	C.I. Mordant Blue 13	*add*	Acid Chrome Navy Blue B	Pol
		add	Alizarine Chrome Blue B	Chem
1532	C.I. Mordant Green 4	*add*	Viridon B	Pol
1551	C.I. Mordant Brown 1	*add*	Acid Chrome Brown EB	Pol
1557	C.I. Mordant Brown 15	*add*	Alizarine Chrome Brown KE	Chem
1565	C.I. Mordant Brown 33	*add*	Acid Chrome Brown 2R	Pol
		add	Alizarine Chrome Brown RH	Chem
1566	C.I. Mordant Brown 35	*add*	Alizarine Chrome Brown V	Chem
1568	C.I. Mordant Brown 40	*add*	Alizarine Chrome Brown PG	Chem
1587	C.I. Mordant Black 5	*add*	Acid Chrome Black FW	Pol
1588	C.I. Mordant Black 7	*add*	Alizarine Chrome Black P2B	Chem
	C.I. Mordant Black 8	*add*	Diacromo Black PLC conc.	Acna
1589	C.I. Mordant Black 9	*add*	Alizarine Chrome Black PV	Chem
1590	C.I. Mordant Black 11	*add*	Acid Chrome Black ET	Pol
		add	Alizarine Chrome Black PT, PT Supra	Chem
1591	C.I. Mordant Black 13	*add*	Alizarine Blue Black B	Chem
1592	C.I. Mordant Black 15	*add*	Acid Chrome Black 4RF	Pol
		add	Alizarine Chrome Black 4R	Chem
1593	C.I. Mordant Black 17	*add*	Alizarine Chrome Black 6B	Chem
1609	C.I. Mordant Black 56	*add*	Acid Chrome Grey GR	Pol
1623	C.I. Basic Orange 1	*add*	Chrysoidine R	Chem
1634	C.I. Basic Violet 3	*add*	Crystal Violet O	Chem
1649	C.I. Basic Brown 1	*add*	Bismarck Brown GC	Chem
1650	C.I. Basic Brown 4	*add*	Vesuvine JBLX	Chem
1735	C.I. Disperse Black 2	*add*	Naphtoelan Black D Base	Pol
1775	C.I. Food Yellow 3	*add*	Acid Yellow TRA	Acna
		add	Yellow SY for Food	Chem
1783	C.I. Food Red 2	*add*	Acid Scarlet GNA	Acna
	C.I. Food Red 3	*add*	Azo Rubine for Food	Chem

Page	*Colour Index Designation*			
1784	**C.I. Food Red 4**	*add*	**Fast Red E ... ... Acna**	
		add	**Red E for Food ... ... Chem**	
1785	**C.I. Food Red 7**	*add*	**Kochineal Red A for Food ... ... Chem**	
	C.I. Food Red 8	*add*	**Ponceau 6RA ... ... Acna**	
	C.I. Food Red 9	*add*	**Victoria Rubine O for Food ... ... Chem**	
1791	**C.I. Food Blue 1**	*add*	**Indigo Carmine AC ... ... Acna**	
1797	**C.I. Food Black 1**	*add*	**Brilliant Black BN ... ... Acna**	
		add	**Brilliant Black BN for Food ... ... Chem**	

VOLUME 2

Additional *Colour Index* Designations and Numbers

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C.I. Azoic Red 65

HUE **Bright Red**
Ronagen Red I4G ... ... RL

C.I. Azoic Red 66

HUE **Bright Reddish Violet**
Ronagen Brilliant Ruby B ... ... RL

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C.I. Azoic Blue 25

HUE **Blue**
Ronagen Brilliant Blue R ... ... RL

C.I. Azoic Blue 26

HUE **Blue**
Ronagen Brilliant Blue 3G ... ... RL

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C.I. Azoic Black 7

HUE **Black**
Ronagen Black IL ... ... RL
Sinagen Black IL ... ... RL

Amendments

Page	*Colour Index Designation*			
2008	**C.I. Direct Yellow 11**	*add*	**Direct Yellow G ... ... Chem**	
2009	**C.I. Direct Yellow 12**	*add*	**Chrysophenine G ... ... Chem**	
2015	**C.I. Direct Yellow 28**	*add*	**Saturn Yellow LFF ... ... Chem**	
2016	**C.I. Direct Yellow 29**	*add*	**Saturn Yellow LRT ... ... Chem**	
2022	**C.I. Direct Yellow 44**	*add*	**Saturn Yellow L4G ... ... Chem**	
2024	**C.I. Direct Yellow 49**	*add*	**Saturn Yellow LG ... ... Chem**	
	C.I. Direct Yellow 50	*add*	**Saturn Yellow LR ... ... Chem**	
2033	**C.I. Direct Yellow 70**	*add*	**Cuprostan Yellow GRLL ... ... Chem**	
2047	**C.I. Direct Orange 26**	*add*	**Direct Fast Orange S ... ... Chem**	
2050	**C.I. Direct Orange 34**	*add*	**Saturn Orange L7G ... ... Chem**	
2051	**C.I. Direct Orange 37**	*add*	**Saturn Orange LER ... ... Chem**	
2075	**C.I. Direct Red 1**	*add*	**Direct Red F ... ... Chem**	

Page	*Colour Index Designation*			
2076	**C.I. Direct Red 2**	*add*	**Cotton Red 4B ... ... Chem**	
2080	**C.I. Direct Red 13**	*add*	**Direct Bordeaux B ... ... Chem**	
2083	**C.I. Direct Red 23**	*add*	**Direct Fast Scarlet 4B ... ... Chem**	
2086	**C.I. Direct Red 28**	*add*	**Cotton Red 4BC ... ... Chem**	
2101	**C.I. Direct Red 75**	*add*	**Saturn Pink 2B ... ... Chem**	
	C.I. Direct Red 76	*add*	**Saturn Scarlet LGG ... ... Chem**	
2103	**C.I. Direct Red 79**	*add*	**Saturn Red L4B ... ... Chem**	
	C.I. Direct Red 80	*add*	**Saturn Red F3B ... ... Chem**	
2104	**C.I. Direct Red 81**	*add*	**Saturn Red B ... ... Chem**	
2105	**C.I. Direct Red 83**	*add*	**Helion Violet 2RL ... ... Pol**	
2143	**C.I. Direct Violet 1**	*add*	**Direct Violet FR ... ... Chem**	
2144	**C.I. Direct Violet 5**	*add*	**Direct Violet RL ... ... Chem**	
2162	**C.I. Direct Violet 66**	*add*	**Saturn Violet L4B ... ... Chem**	
2170	**C.I. Direct Blue 2**	*add*	**Direct Black BH ... ... Chem**	
2172	**C.I. Direct Blue 6**	*add*	**Direct Blue 2B ... ... Chem**	
2173	**C.I. Direct Blue 8**	*add*	**Direct Blue G ... ... Chem**	
2193	**C.I. Direct Blue 67**	*add*	**Saturn Blue L3R ... ... Chem**	
2195	**C.I. Direct Blue 71**	*add*	**Saturn Blue LBRR ... ... Chem**	
2198	**C.I. Direct Blue 78**	*add*	**Saturn Blue L4G ... ... Chem**	
2201	**C.I. Direct Blue 86**	*add*	**Saturn Turquoise Blue LG ... ... Chem**	
2205	**C.I. Direct Blue 98**	*add*	**Saturn Blue LFBG ... ... Chem**	
2208	**C.I. Direct Blue 106**	*add*	**Saturn Blue LFF2G ... ... Chem**	
2213	**C.I. Direct Blue 120**	*add*	**Azogen Blue BR ... ... Chem**	
2227	**C.I. Direct Blue 159**	*add*	**Cuprostan Blue GLL ... ... Chem**	
2229	**C.I. Direct Blue 162**	*add*	**Cuprostan Blue RLL ... ... Chem**	
2231	**C.I. Direct Blue 168**	*add*	**Direct Blue CBB ... ... Chem**	
2237	**C.I. Direct Green 1**	*add*	**Direct Black Green N ... ... Chem**	
2239	**C.I. Direct Green 6**	*add*	**Direct Green B ... ... Chem**	
2240	**C.I. Direct Green 8**	*add*	**Direct Green TG ... ... Chem**	
2250	**C.I. Direct Green 34**	*add*	**Saturn Green LBT ... ... Chem**	
2264	**C.I. Direct Brown 2**	*add*	**Direct Brown M ... ... Chem**	
2272	**C.I. Direct Brown 25**	*add*	**Direct Catechine G ... ... Chem**	
2273	**C.I. Direct Brown 27**	*add*	**Direct Brown B3G ... ... Chem**	
2276	**C.I. Direct Brown 33**	*add*	**Direct Catechine B ... ... Chem**	
2286	**C.I. Direct Brown 59**	*add*	**Direct Brown B ... ... Chem**	
2292	**C.I. Direct Brown 78**	*add*	**Koranil Brown L3R ... ... Chem**	
		add	**Saturn Brown L3R ... ... Chem**	
2295	**C.I. Direct Brown 95**	*add*	**Saturn Brown LBR ... ... Chem**	
2297	**C.I. Direct Brown 101**	*add*	**Saturn Brown 2RT ... ... Chem**	
2301	**C.I. Direct Brown 112**	*add*	**Saturn Brown L8R ... ... Chem**	
2316	**C.I. Direct Brown 162**	*add*	**Cuprostan Brown RL ... ... Chem**	
2321	**C.I. Direct Brown 175**	*add*	**Cuprostan Brown 5RLL ... ... Chem**	
2326	**C.I. Direct Black 4**	*add*	**Direct Black RW ... ... Chem**	
2328	**C.I. Direct Black 9**	*add*	**Direct Black FF ... ... Chem**	
2331	**C.I. Direct Black 17**	*add*	**Azogen Black D ... ... Chem**	
2332	**C.I. Direct Black 19**	*add*	**Direct Fast Black G ... ... Chem**	
2339	**C.I. Direct Black 38**	*add*	**Direct Black GW ... ... Chem**	
		add	**Formaline Black C ... ... Chem**	
	C.I. Direct Black 41	*add*	**Velur Leather Black S ... ... Chem**	
2342	**C.I. Direct Black 51**	*add*	**Saturn Black B, VE ... ... Chem**	
2344	**C.I. Direct Black 56**	*add*	**Saturn Grey LRN ... ... Chem**	
2381	**C.I. Solubilised Sulphur Blue 10** under "Applied by method 6"	*add*	**Sulphosol Sky Blue S3B ... ... JR**	
2413	**C.I. Solubilised Sulphur Black 1** under "Applied by method 4"	*add*	**Lyosulfogen Black B ... ... Chem**	
	under "Applied by method 6"	*add*	**Sulfatin Black BWLE ... ... Chem**	
		add	**Sulfosol Black TG ... ... Chem**	
2417	**C.I. Sulphur Black 11** under "Applied by method 1"	*add*	**Sulfocarbon CL ... ... Chem**	
2428	**C.I. Vat Yellow 2**	*add*	**Ostanthren Yellow GC ... ... Chem**	
2430	**C.I. Vat Yellow 4**	*add*	**Helanthrene Yellow GOK ... ... Pol**	

Page	*Colour Index Designation*			
2432	**C.I. Vat Yellow 9**	*add*	**Ostanthren Yellow GF ... ... Chem**	
2439	**C.I. Vat Yellow 26**	*add*	**Helanthrene Yellow 5GK ... ... Pol**	
		add	**Ostanthren Yellow 5GK ... ... Chem**	
2443	**C.I. Vat Orange 1**	*add*	**Helanthrene Yellow RK ... ... Pol**	
2445	**C.I. Vat Orange 3**	*add*	**Helanthrene Orange RK ... ... Pol**	
2447	**C.I. Vat Orange 5**	*add*	**Vat Orange RF ... ... Pol**	
2450	**C.I. Vat Orange 11**	*add*	**Helanthrene Yellow 3RT ... ... Pol**	
		add	**Ostanthren Yellow 3RT ... ... Chem**	
2454	**C.I. Vat Orange 19**	*add*	**Helanthrene Orange GK ... ... Pol**	
2455	**C.I. Vat Red 1**	*add*	**Helanthrene Pink R ... ... Pol**	
2475	**C.I. Vat Red 45**	*add*	**Helanthrene Scarlet GG ... ... Pol**	
2479	**C.I. Vat Violet 1**	*add*	**Romantrene Brilliant Violet F2R, F4R Acna**	
2485	**C.I. Vat Violet 9**	*add*	**Romantrene Brilliant Violet F3B ... Acna**	
2494	**C.I. Vat Blue 4**	*add*	**Helanthrene Blue RS ... ... Pol**	
		add	**Ostanthren Blue RSN, RS ... ... Chem**	
	under "Special physical forms for paper, etc."	*add*	**Ostanthren Blue RSZ ... ... Chem**	
		add	*(Specially prepared physical form for printing inks)* **Versal Blue GGSL ... ... Chem**	
2495	**C.I. Vat Blue 5**	*add*	**Vat Blue 4B ... ... Pol**	
2496	**C.I. Vat Blue 6**	*add*	**Helanthrene Blue BC, GCD ... ... Pol**	
		add	**Ostanthren Blue BCL, BCS ... ... Chem**	
	under "The following brands are similar"	*add*	**Romantrene Blue FRC ... ... Acna**	
2500	**C.I. Vat Blue 12**	*add*	**Ostanthren Blue Ti ... ... Chem**	
	under "Purified brands"	*add*	**Romantrene Brilliant Blue F3G ... Acna**	
2501	**C.I. Vat Blue 14**	*add*	**Ostanthren Blue GCD, GCG ... ... Chem**	
2502	**C.I. Vat Blue 16**	*add*	**Romantrene Navy Blue FG ... ... Acna**	
2504	**C.I. Vat Blue 20**	*add*	**Helanthrene Dark Blue BO ... ... Pol**	
2506	**C.I. Vat Blue 25**	*add*	**Ostanthren Navy Blue R ... ... Chem**	
2513	**C.I. Vat Blue 42**	for	**Vat Blue G ... ... Acna**	
		read	**Tinaldene Blue G ... ... Acna**	
2514	**C.I. Vat Blue 43**	*add*	**Hydron Blue 3R ... ... CFM**	
		add	**Tinaldene Blue CR, 2R ... ... Acna**	
2519	**C.I. Vat Green 1**	*add*	**Brilliant Green FFB ... ... Chem**	
		add	**Helanthrene Green B ... ... Pol**	
2520	**C.I. Vat Green 2**	*add*	**Romantrene Brilliant Green F2G ... Acna**	
		add	**Helanthrene Green 2G ... ... Pol**	
2521	**C.I. Vat Green 3**	*add*	**Helanthrene Olive Green B ... ... Pol**	
		add	**Ostanthren Olive Green B ... ... Chem**	
2524	**C.I. Vat Green 7**	*add*	**Vat Olive C2G ... ... Pol**	
2531	**C.I. Vat Brown 1**	*add*	**Ostanthren Brown BR ... ... Chem**	
2533	**C.I. Vat Brown 5**	*add*	**Helanthrene Brown RD ... ... Pol**	
2541	**C.I. Vat Brown 25**	*add*	**Ostanthren Reddish Brown 5RF ... Chem**	
2548	**C.I. Vat Brown 44**	*add*	**Helanthrene Brown GR ... ... Pol**	
2554	**C.I. Vat Black 8**	*add*	**Ostanthren Grey M ... ... Chem**	
2560	**C.I. Vat Black 25**	*add*	**Romantrene Olive FT ... ... Acna**	
2561	**C.I. Vat Black 27**	*add*	**Ostanthren Olive R ... ... Chem**	
2562	**C.I. Vat Black 29**	*add*	**Romantrene Grey FBG ... ... Acna**	
2571	**C.I. Azoic Diazo Component 1**	*add*	**Fast Bordeaux GP Base ... ... Chem**	
		add	**Naphtoelan Bordeaux GP Base ... Pol**	
2572	**C.I. Azoic Diazo Component 2**	*add*	**Naphtoelan Orange GC Base ... ... Pol**	
2573	**C.I. Azoic Diazo Component 3**	*add*	**Fast Red SGG Base ... ... Chem**	
		add	**Naphtoelan Scarlet GG Base ... ... Pol**	
2574	**C.I. Azoic Diazo Component 4**	*add*	**Fast Garnet GBC Base ... ... Chem**	
2575	**C.I. Azoic Diazo Component 5**	*add*	**Fast Red B Base ... ... Chem**	
		add	**Naphtoelan Red B Base ... ... Pol**	
2577	**C.I. Azoic Diazo Component 7**	*add*	**Naphtoelan Orange R Base ... ... Pol**	
2578	**C.I. Azoic Diazo Component 8**	*add*	**Fast Red GL Base ... ... Chem**	
		add	**Naphtoelan Red GL Base ... ... Pol**	
2579	**C.I. Azoic Diazo Component 9**	*add*	**Fast Red 3GL spec. Base ... ... Chem**	
		add	**Naphtoelan Red 3GL Base ... ... Pol**	
2582	**C.I. Azoic Diazo Component 12**	*add*	**Fast Red SG Base ... ... Chem**	
		add	**Naphtoelan Scarlet G Base ... ... Pol**	

Page	*Colour Index Designation*			
2583	**C.I. Azoic Diazo Component 13**	*add*	**Fast Red SRC Base ... ... Chem**	
		add	**Naphtoelan Scarlet RC Base ... ... Pol**	
2586	**C.I. Azoic Diazo Component 20**	*add*	**Fast Blue BB Base ... ... Chem**	
2587	**C.I. Azoic Diazo Component 22**	*add*	**Naphtoelan Navy Blue RT Salt ... Pol**	
2592	**C.I. Azoic Diazo Component 32**	*add*	**Fast Red KB Base ... ... Chem**	
		add	**Naphtoelan Red KB Base ... ... Pol**	
2594	**C.I. Azoic Diazo Component 34**	*add*	**Naphtoelan Red RL Base ... ... Pol**	
2595	**C.I. Azoic Diazo Component 35**	*add*	**Naphtoelan Blue BT Salt ... ... Pol**	
		add	**Variamine Blue Salt B ... ... Chem**	
2598	**C.I. Azoic Diazo Component 38**	*add*	**Naphtoelan Black K Salt ... ... Pol**	
2601	**C.I. Azoic Diazo Component 41**	*add*	**Naphtoelan Violet B Base ... ... Pol**	
2602	**C.I. Azoic Diazo Component 42**	*add*	**Fast Red ITR Base ... ... Chem**	
		add	**Naphtoelan Red JTR Base ... ... Pol**	
2604	**C.I. Azoic Diazo Component 44**	*add*	**Fast Yellow OC Base ... ... Acna**	
		add	**Fast Yellow OC Salt ... ... Acna**	
		add	**Naphtoelan Yellow GC Base ... ... Pol**	
2613	**C.I. Azoic Coupling Component 2**	*add*	**Ultrazol I-AS ... ... Chem**	
2614	**C.I. Azoic Coupling Component 4**	*add*	**Ultrazol VII-BO ... ... Chem**	
	C.I. Azoic Coupling Component 5	*add*	**Ultrazol G ... ... Chem**	
2616	**C.I. Azoic Coupling Component 12**	*add*	**Ultrazol IX-ITR ... ... Chem**	
2618	**C.I. Azoic Coupling Component 17**	*add*	**Ultrazol IV-BS ... ... Chem**	
	C.I. Azoic Coupling Component 18	*add*	**Ultrazol D ... ... Chem**	
2629	**C.I. Azoic Yellow 1**	*add*	**Citazolo Yellow NG ... ... Acna**	
2641	**C.I. Azoic Red 1**	*add*	**Citazolo Scarlet NR ... ... Acna**	
	C.I. Azoic Red 2	*add*	**Citazolo Red NR ... ... Acna**	
2642	**C.I. Azoic Red 6**	*add*	**Citazolo Red NG ... ... Acna**	
2649	**C.I. Azoic Red 29**	*add*	**Citazolo Scarlet N3R ... ... Acna**	
2662	**C.I. Azoic Blue 6**	*add*	**Citazolo Blue NB ... ... Acna**	
2683	**C.I. Oxidation Base 2**	*add*	**Futramine Grey B ... ... Pol**	
2684	**C.I. Oxidation Base 3**	*add*	**Printing Black A ... ... Pol**	
2685	**C.I. Oxidation Base 6**	*add*	**Benzofur P ... ... Chem**	
		add	**Futramine P ... ... Pol**	
2687	**C.I. Oxidation Base 10**	*add*	**Benzofur D ... ... Chem**	
		add	**Futramine D ... ... Pol**	
2688	**C.I. Oxidation Base 13A**	*add*	**Renal Brown SO ... ... Acna**	
2690	**C.I. Oxidation Base 17**	*add*	**Benzofur GG ... ... Chem**	
2691	**C.I. Oxidation Base 20**	*add*	**Benzofur MT ... ... Chem**	
2696	OXIDATION BASES—MIXTURES OF KNOWN CONSTITUTION	*add*	**Benzofur MZ**	**Chem**
				C.I. 76060 + C.I. 76505
2703	**C.I. Pigment Yellow 1**	*add*	**Segnale Light Yellow AG, GM ... Acna**	
		add	**Versal Yellow G ... ... Chem**	
2704	**C.I. Pigment Yellow 3**	*add*	**Versal Yellow 10G ... ... Chem**	
2705	**C.I. Pigment Yellow 5**	*add*	**Versal Yellow 5G ... ... Chem**	
2706	**C.I. Pigment Yellow 10**	*add*	**Versal Yellow R ... ... Chem**	
2707	**C.I. Pigment Yellow 12**	*add*	**Segnale Light Yellow 2GRT ... ... Acna**	
2708	**C.I. Pigment Yellow 14**	*add*	**Versal Fast Yellow PG ... ... Chem**	
	C.I. Pigment Yellow 16	*add*	**Segnale Light Yellow NCG ... ... Acna**	
		add	**Termosolido Yellow GL Supra ... Acna**	
2720	**C.I. Pigment Orange 5**	*add*	**Segnale Light Orange RNG ... ... Acna**	
		add	**Versal Orange RNL ... ... Chem**	
2722	**C.I. Pigment Orange 13**	*add*	**Segnale Light Orange PG ... ... Acna**	
2725	**C.I. Pigment Red 2**	*add*	**Versal Fast Red F2R ... ... Chem**	
2726	**C.I. Pigment Red 3**	*add*	**Segnale Light Red 2B, C4R ... ... Acna**	
		add	**Segnale Red BR ... ... Acna**	
		add	**Versal Scarlet PRNL, RNL ... ... Chem**	
2727	**C.I. Pigment Red 4**	*add*	**Segnale Light Red PRG ... ... Acna**	
		add	**Versal Fast Red PR, R ... ... Chem**	
2728	**C.I. Pigment Red 8**	*add*	**Segnale Light Red 4RS ... ... Acna**	
		add	**Versal Fast Red F4R ... ... Chem**	
	C.I. Pigment Red 9	*add*	**Segnale Light Red F2L ... ... Acna**	
2729	**C.I. Pigment Red 10**	*add*	**Versal Fast Red FRL ... ... Chem**	

Page	*Colour Index Designation*			
2730	**C.I. Pigment Red 16**	*add*	**Versal Bordeaux F3R**	**Chem**
2741	**C.I. Pigment Red 49**			
	under "Calcium lake"	*add*	**Segnale Bordeaux RD**	**Acna**
		add	**Segnale Red RC**	**Acna**
		for	**Lake Red RCKK**	**Pol**
		read	**Lake Red RCKX**	**Pol**
	under "Barium lake"	*add*	**Segnale Red RB**	**Acna**
		for	**Lake Red RBKK**	**Pol**
		read	**Lake Red RBKX**	**Pol**
2743	**C.I. Pigment Red 53**			
	under "Barium lake"	*add*	**Segnale Red LCB, LCG**	**Acna**
2744	**C.I. Pigment Red 54**	*add*	**Segnale Light Bordeaux 2BL**	**Acna**
		add	**Versal Bordeaux BL**	**Chem**
2745	**C.I. Pigment Red 57**	*add*	**Segnale Rubine BKG**	**Acna**
		add	**Versal Fast Red PF6R** (in rubber) ...	**Chem**
	under "Calcium lake"	*add*	**Versal Fast Red F6R**	**Chem**
		add	**Versal Rubine BNCAE, PBNCAE** ...	**Chem**
	under "Barium lake"	*add*	**Versal Rubine BNBA, PBNBA** ...	**Chem**
2746	**C.I. Pigment Red 58**			
	under "Manganese lake"	*add*	**Segnale Light Amaranth B Bright** ...	**Acna**
2747	**C.I. Pigment Red 60**			
	under "Barium lakes"	*add*	**Versal Scarlet 3BBA**	**Chem**
2773	**C.I. Pigment Blue 15**	*add*	**Segnale Light Turquoise BDS, BF** ...	**Acna**
		add	**Versal Blue B, PB, NCB**	**Chem**
		add	**Vulcol Fast Blue 3G**	**Acna**
2776	**C.I. Pigment Blue 24**	*add*	**Segnale Turquoise Blue PV**	**Acna**
2783	**C.I. Pigment Green 7**	*add*	**Segnale Light Green G**	**Acna**
		add	**Termosolido Green FG Supra** ...	**Acna**
		add	**Versal Green G**	**Chem**
		add	**Vulcol Fast Green F2G**	**Acna**
	C.I. Pigment Green 8	*add*	**Pigment Green BM**	**Acna**
		add	**Versal Green B, PB**	**Chem**
2795	**C.I. Pigment Black 1**	*add*	**Pigment Black SC**	**Acna**
		add	**Versal Black CR Supra**	**Chem**
2807	**C.I. Pigment White 19** under **Standards** after India IS 68; CDC 3 (896)	*add*	Kaolin for cosmetic industry	
2808	**C.I. Pigment White 26** under **Standards** after India IS 68; CDC 3 (894)	*add*	Talc for cosmetic industry	
2817	**C.I. Solvent Yellow 2**	*add*	**Resinol Yellow GR**	**Chem**
2821	**C.I. Solvent Yellow 14**	*add*	**Resinol Orange R**	**Chem**
2822	**C.I. Solvent Yellow 16**	*add*	**Resinol Yellow 3G**	**Chem**
2833	**C.I. Solvent Orange 1**	*add*	**Resinol Orange G**	**Chem**
2843	**C.I. Solvent Red 1**	*add*	**Resinol Red G**	**Chem**
2850	**C.I. Solvent Red 24**	*add*	**Resinol Red 2B**	**Chem**
2858	**C.I. Solvent Red 49**	*add*	**Rhodamine B Base**	**Acna**
2869	**C.I. Solvent Violet 8**	*add*	**Methyl Violet 2B Base**	**Acna**
2871	**C.I. Solvent Violet 14**	*add*	**Alizarine Violet A Base**	**Acna**
2874	**C.I. Solvent Blue 4**	*add*	**Victoria Blue B Base**	**Acna**
2891	**C.I. Solvent Brown 1**			
	under "Note"	*add*	**Resinol Brown RRN**	**Chem**
	C.I. Solvent Brown 3	*add*	**Resinol Brown R**	**Chem**
2892	**C.I. Solvent Brown 5**	*add*	**Resinol Brown 2B**	**Chem**
2900	**C.I. Solvent Black 5**	*add*	**Brilliant Black LB**	**Chem**
2901	**C.I. Solvent Black 7**	*add*	**Nigrosine G Base**	**Chem**
2914	**C.I. Fluorescent Brightening Agent 30**	*add*	**Citalba R conc.**	**Acna**
2925	**C.I. Developer 1**	*add*	**Azogen Developer C**	**Chem**
2926	**C.I. Developer 5**	*add*	**Azogen Developer A**	**Chem**
2927	**C.I. Developer 8**	*add*	**Developer ON**	**Chem**
2928	**C.I. Developer 14**	*add*	**Azogen Developer H**	**Chem**
2931	**C.I. Reducing Agent 2**	*add*	**Hydrosulphite SC**	**SIDS**
2932	**C.I. Reducing Agent 3**	*add*	**Hydrosulphite SCW**	**SIDS**
	C.I. Reducing Agent 4	*add*	**Hydrosulphite SZ**	**SIDS**
	C.I. Reducing Agent 5	*add*	**Hydrosulphite SCL**	**SIDS**
	C.I. Reducing Agent 6	*add*	**Hydrosulphite SZS**	**SIDS**
2933	**C.I. Reducing Agent 9**	*add*	**Hydrosulphite SAZA**	**SIDS**

VOLUME 3

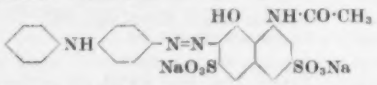
Amendments

PREAMBLE TO PART II

In the last sentence of the first paragraph, for (*) *read* (★), and in the third line of the next page for (indicated by *) *read* (indicated by ★).

Page	*Colour Index No.*
3105	*add*

18058 **Acid Blue 174** ( ) *Discoverer*—Pol



N-Phenyl-*p*-phenylenediamine→*N*-Acetyl H acid

3139	under **21135**	*add*	A pigment of this constitution is now commercially available as **Versal Fast Yellow PR** ... ... **Chem**
3325	under **37245**	*add*	Diazo components of this constitution are now commercially available as **Fast Black B Base** ... ... **Acna** **Fast Black B Salt** ... ... **Acna**
3572	under **74260**	for	(3) Convert tetrachlorophthalic anhydride to hexachloro copper phthalocyanine—
		read	(3) Convert tetrachlorophthalic anhydride to hexadecachloro copper phthalocyanine—
3604	under **77004** under **Standards** after India IS 68; CDC 3 (896)	*add*	Kaolin for cosmetic industry

VOLUME 4

Amendments

Page				
4001		*add*	Chem	Chemapol, Prague, Czechoslovakia
4005		*add*	Chemapol, Prague, Czechoslovakia (Chem)	
4421	*beneath* Rutin *add* **Rylux**		Chem	Fluorescent Brightening Agents
4466	*beneath* Texan Red Toner D *add* **Texiprint**		Scott Bader & Co. Ltd Wollaston, Wellingborough Northants, England	Pigment dispersions
4491	*beneath* Yeast Black for Yeast 27175N Specially Pure *read* Yellow 27175N Specially Pure i.e. the following thirty-six items should be preceded by "Yellow", and not by "Yeast".			
4555	in 1010 under **C.I. Acid Yellow 17**	*delete*	"*add* **Fast Acid Yellow 2G** ... ... **Pol**"	
4560	*delete* "1591 under **C.I. Mordant Black 13**	*add*	**Acid Chrome Navy Blue B** ... ... **Pol**"	
4577	in 3142 under **21540**	for	**Diazol Black BW** ... ... **Pol**	
		read	**Diazo Black BW** ... ... **Pol**	

New Books and Publications

Färberei-Praxis

Teil I

Das Färben nativer Fasern

(Baumwolle, Flachs, Hanf, Jute, Kokos, Stroh)

Pp. 104. Price, DM 12.80.

Teil II

Praxis der Baumwollfärberei

1957. Pp. 154. Price, DM 16.80.

By Willi Festerling. Heidenheim (Brenz), Germany: Verlag Alfred Halscheidt.

There is a notable shortage of up-to-date books on the dyeing of cellulosic fibres; hence the appearance of these two volumes is undoubtedly welcome. They are both of a strictly practical nature. The first volume, in spite of its broad title, is substantially concerned with cotton, with only a very small proportion of space allotted to the dyeing of linen, jute, hemp, coir, and straw. There is, therefore, a considerable amount of repetition from the first volume in the second. It is easy to be wise after the event, and the impression is given that the cotton dyeing book was not envisaged when the general work was written; but the volumes are appearing in a series on *Dyehouse Practice*, and the publishers ought to have guided the author into excluding much of the repetitive matter in the second book, whilst including rather more theory or diagrams, or both.

Das Färben nativer Fasern commences with brief treatments of the physical and chemical properties of cotton, sizing, desizing, kiering, and bleaching. "One of the most important, but at the same time most difficult and yet most interesting fields in the textile industry is dyeing". No one versed in the art could disagree with the author's opening remarks, nor is there anything contentious in the sections which follow, dealing with the application of dyes classed as direct, basic, sulphur, vat, azoic, and oxidation, with Turkey Red completing the account. If there is any criticism, it is that the sections are no more original than the dyers' handbooks which most dyemakers have produced at various times. The author will undoubtedly find that this book will have to compete, in any event so far as students are concerned, with material in no way inferior, and in most cases gratis— all of which is bad business.

The book on cotton dyeing does not suffer from these defects. Here the author has set out to describe bulk practice under the four main headings of loose fabric, hank, package, and piece. The machines used for each form are considered, and up-to-the-minute examples are quoted. The photographs, in spite of the poor quality of the paper, are excellent, but the frequently more informative line diagrams are rather scarce. For each textile form the dye classes most commonly used are considered, and particularly valuable are the numerous bulk recipes containing sufficient working detail to allow a student to visualise the procedure or a dyer to carry out the operation, if it were new to him.

Both books are slim, and the author makes no more than modest claims for them. While the encyclopaedic Dyeing Course of our Swiss sister society is slowly taking shape, German-speaking readers will have to content themselves, gratefully, with smaller-scale efforts such as these. So far as English readers are concerned, the books are of no more than academic interest, largely because the practical details are exclusively based on German dyes and speciality chemicals.

S. R. COCKETT

Methoden der organischen Chemie (Houben-Weyl)

Band XI/2

Stickstoff-Verbindungen II und III

Edited by Eugen Müller. 4th edition 1958. Pp. xlviii + 840. Stuttgart: Georg Thieme Verlag. Price, DM 155.00.

It was announced in the preface to Volume XI/1, which dealt with the various preparative methods for amines, that space requirements compelled a review of the reactions and transformations of amines to be made in a second volume, and this continuation now occupies the first 221 pages of Volume XI/2. Here, however, only such reactions of primary, secondary, and tertiary amines are considered which do not eventually return to amines, so that, whereas alkylation and dealkylation have been placed in Volume XI/1, the conversion of amines into other classes such as carbonamides (excluding lactams, which require a separate section), amidines, nitramines, amino-oxides, and deaminations (via nitrous acid reactions) are now described separately here (in II, XI/2) owing to the importance they have acquired within recent years and also to the absence of any résumé of them in current literature. The final section of this part deals with methods for the elimination of the amino group, the conversion of aliphatic amines into olefins, the replacement of the amino group by hydrocarbon radicals, the multifarious conversions of primary aromatic amines via intermediate diazo compounds, and the various transformations of tertiary amines and quaternary ammonium compounds. Also included are special methods for the replacement of the amino group by halogen and hydroxyl, and for the use of amines as starting materials for the preparation of aldehydes and ketones. As an example of the thoroughness of the treatment, no fewer than twenty methods are listed for the replacement of the amino group by hydrogen.

Since the 1:2- and 1:3-alkyleneimines are not regarded as true amines, they occupy separate reactions in Part III of this volume, where their special preparation by ring closure methods, and reactions, analysis, toxicology, and pharmacology receive adequate attention. Next in order come the aminocarboxylic acids, for which special ingenious preparative methods have been devised as well as for their separation and isolation; as a consequence of the individuality of each amino

acid, their syntheses and characteristic reactions are dealt with separately. Then follows a comprehensive treatment of the lactams, which includes reactions of the NH and CO groups, and the changes brought about by hydrolysis, pyrolysis, and polymerisation, after which a useful section is devoted to methods for the preparation of quaternary ammonium compounds and to constitutional influences on their reactions. The final section, on nitrogen–sulphur compounds, describes the *N*-substituted sulphamic acids with their sulphonhalides and esters, the substituted sulphurylamides, the *N*-sulphinic acids and their halides, esters, amines, and imines, and the nitrogen compounds of bivalent sulphur including the preparation and reactions of *N*-sulphenic acid halides, *NN'*-bisaminosulphides, and *NN'*-bisamino-di- and -poly-sulphides.

In all cases, the patent as well as the scientific literature has been thoroughly searched, and the author index of 50 three-column pages and subject index of 38 two-column pages give some idea of the magnitude of this task. The book itself needs no commendation from a reviewer, and the appreciation already accorded to a previous volume (cf. J.S.D.C., **69**, 133 (1953)) applies with equal force to this, its most recent companion; it is indispensable to those who work on topics in the fields under consideration.

H. H. Hodgson

Modern Carpet Manufacture

By A. Crossland. Pp. vii + 176 + XV plates. Manchester and London: Columbine Press. 1958. Price, 21s. 0d.

Since the publication of the latest of the few textbooks on carpet manufacture, there have been many important developments in this old yet expanding industry, and therefore the author is to be congratulated on so successfully bridging the gap.

This handy textbook will be of particular value to students entering the industry. The style and presentation of the subject-matter should enable the reader to understand readily the differences in construction of the various types of carpets described and the techniques employed in their manufacture. Its comprehensive nature should render it invaluable to both those employed in the industry and those in the associated distributive trades.

The introductory chapter, which contains a historical survey, refers to famous Oriental carpets, and explains the symbolic value of many motifs in the beautiful designs. When dealing with European developments, mention is made of early English designs, which were heraldic and include the well known Verulam carpet bearing Elizabeth's arms and date, and a border of honeysuckle and oak stems.

A wide field is covered in the next two chapters, including raw materials, yarn counts and calculations (the Tex system is not mentioned), scouring, and dyeing; the information given is thus somewhat restricted and will be of most benefit to those not seriously concerned with the scientific aspects of carpet manufacture. In the dyeing section attention is drawn to the numerous shades in current demand, and the heavy weights of yarn to be dyed in one load. This has led to the use of "linked" Hussong-type machines, and the greater use of "stock-dyed" yarns for plain carpets and open ground shades; the latter method facilitates the use of milling acid and metal-complex dyes.

The main part of the book is concerned with the preparatory operations and weaving of conventional types of carpets, namely figured, plain, seamless, and face-to-face Wilton, and spool, gripper, and chenille Axminster types. In chapters dealing with design and colour and carpet construction, explanations are given of the various methods of control of design during weaving. Finally a detailed account of the manufacture of tufted carpets is included, also descriptions of the methods employed in the production of needle-loom, Karvel, and "electrostatic adhesive-bonded" pile floorcoverings.

The book is well produced and contains many excellent diagrams and photographic reproductions.

G. Robinson

New Books received

Fundamentals of High Polymers. O. A. Battista. New York: Reinhold Publishing Corpn. (London: Chapman & Hall Ltd.). 1958. Pp. ix + 140. 44s. 0d. ($5.50).

Teoriya krasheniya i opyt ee prakticheskogo primeneniya. L. I. Belen'kii. Moscow: Gislegprom. 1958. Pp. 192. 8 roubles 20 kopeks.

Journal of the Bradford Textile Society 1957–1958. Bradford: Bradford Textile Society. 1958. Pp. 137 + 5 illustrations. 10s. 0d.

Perkin Centenary London. 100 Years of Synthetic Dyestuffs. London: Pergamon Press Ltd. 1958. Pp. xii + 136 + viii plates. 42s. 0d.

Symposium over Kleur en Structuur van Organische Verbindingen. Brussels: Vlaamse Chemische Vereniging. [1958.] Pp. 198. Belgian francs 150.

Peter Griess (1829–1888) and the Burton Breweries. E. R. Ward. London: Royal Institute of Chemistry. 1958. Pp. 13 + 1 plate. (Reprint.)

Manufacturers' Publications and Pattern Cards

The Society does not accept any responsibility with regard to the statements in the following notes.
Any publication abstracted may be referred to by members of the Society on application to
Dr. C. B. Stevens, Dyeing Department, Leeds University

American Cyanamid Co.

DYES TECHNICAL BULLETIN NO. 849. PACKAGE DYEING: APPLICATION OF VAT DYES— This bulletin has been prepared by O. W. Clark. Its 63 pages contain a mass of information on the fundamental dyeing methods and bulk dyeing procedures for applying vat dyes to cotton, viscose rayon, nylon, wool and mixtures containing wool and cotton–viscose rayon mixture yarns in the form of wound packages. A full description of a wide range of package machines is included together with details of package winding and shaping. The text includes a large number of photographs and diagrams and four colour plates showing the effect of temperature and retarding agents on dyebath exhaustion and migrating properties of 40 individual dyes. Notes on some causes of faulty dyeings are included and also a bibliography with 37 references.

Badische Anilin- & Soda-Fabrik

INDANTHREN, ANTHRA AND BRILLIANT INDIGO DYESTUFFS IN TWO-PHASE PRINTING— This card contains a screen print on a linen–viscose rayon staple mixture cloth and a machine print on cotton cretonne of sixty-five different vat dyes from the Indanthren, Anthra, and Brilliant Indigo ranges, together with nine examples from bulk production of multi-coloured prints illustrating some of the possible styles and printing methods which may be employed using the colloresin process. All the prints have been developed by padding with an alkaline solution of Rongalit followed by wet steaming. The text, which is bound as a separate booklet and inserted in a pocket inside the pattern card proper, includes a general survey of two-phase printing and the various methods of development together with application data and supplementary fastness data.

INDANTHREN BLUE CLF— This vat dye gives bright blues on cellulosic fibres. It is very level dyeing and is suitable for use alone and in mixtures for producing pale to medium depths on all forms of material. If dyeings are to be treated with hypochlorite the pH of the bath and the goods should be > 11. Pale to medium depth dyeings may be discharged to white. Articles to be repeatedly washed, curtains and furnishings dyed with Indanthren Blue CLF may be marked with the "Indanthren" label without any restriction on depth of colour. Fastness figures on cotton include— Light 7–8, washing (*c*) (95°c.) 4–5, soda boiling (*b*) 4–5, chlorine (*b*) 4–5.

ORTOLAN BROWN 3G: BROWN 2G: BROWN B— These three neutral-dyeing metal-complex dyes give yellow to violet browns on wool, silk and polyamide fibres, the dyeings obtained being characterised by very good fastness to light and wet treatments. They are level dyeing and may be applied at all stages of processing. They are also of interest for Vigoureux and direct printing. Fastness figures on wool include—

	Light	Washing (*b*) (40°c.)	Alkaline milling (*b*)
Brown 3G	6	4–5	4
Brown 2G	6	4	4–5
Brown B	6–7	4	4–5

ORTOLAN BORDEAUX FBB— This neutral-dyeing metal-complex dye gives bright bordeaux on wool and polyamide fibres. It is similar in dyeing characteristics and gives dyeings of the same high standard of fastness as the other members of the range. Fastness figures on wool include— Light 6, washing (*b*) (60°c.) 4–5, alkaline milling (*b*) 5.

EMULPHOR AF— An emulsifying agent for paraffin wax.

NEKANIL LN— A non-ionic detergent for wool scouring.

PERSISTOL EXTRA— A water-proofing compositnio based on a paraffin wax emulsion containing zirconium giving a single-bath proof of good fastness to washing on all types of textile fibres.

Farbwerke Hoechst AG.

REMAZOL DYES: MACHINE PRINTS ON MERCERISED COTTON AND VISCOSE RAYON— This card contains forty prints in two depths on mercerised cotton and viscose rayon cloth produced with either single dyes or two and three colour mixtures.

FAST BORDEAUX SALT BRH— This stabilised diazo compound gives bordeaux with most coupling components in the Naphtol AS range and browns with Naphtols AS-BT, AS-KN, AS-LB and mixtures of them. Combinations based upon it have good fastness to washing and very good fastness to light. It has good stability in solution and during storage at elevated temperatures. Readily dischargeable grounds are obtainable with Naphtol AS, AS-BS, AS-LT, and AS-ITR using a neutral Rongalite discharge. Such grounds do not change their hue during steaming nor form halos during discharging. Fastness figures for the combination with Naphtol AS-S on cotton include— Light 6, washing (95°c.) 5, perspiration 5.

J. R. Geigy AG.

DIPHENYL BRILLIANT FLAVINE 7GFF— This direct dye gives exceptionally bright, fluorescent greenish-yellows on cellulosic fibres. In combination with Solophenyl Turquoise Blue GRL or Diphenyl Brilliant Green G it gives very bright greens, the combination with the latter being particularly suitable for dyeings subsequently to be crease-resisted. Both urea- and melamine-formaldehyde resin finishes improve the light fastness. As the only fluorescent direct dye it should be of interest for fashion colours. Fastness figures on cotton include— Light 3, washing (*a*) (40°c.) 3–4.

IRGANOL GREEN 2GLS— This anthraquinone neutral-dyeing acid dye gives bluish greens of excellent fastness to light and wet treatments on wool, silk, and polyamide fibres and is compatible in dyeing behaviour with all the other Irganol S and Irgalan dyes. It is also of interest for direct printing on chlorinated wool. Fastness figures on wool include— Light 6–7, washing (*b*) 4, severe milling 4, potting 4.

IRGANOL RED RLS— This neutral-dyeing acid dye gives bluish reds on wool, silk, and polyamide fibres. It is similar in dyeing behaviour to the BLS brand but the dyeings on wool are purer and on silk much purer than those obtained with the latter. Cellulosic fibres are reserved white. It is also of interest for direct prints on wool.

James Robinson & Co. Ltd.

SULPHOSOL DYESTUFFS— This card contains dyeings in two depths on cotton and viscose rayon cloth of seventeen water soluble sulphur dyes. They may be applied to cotton from a normal sodium sulphide dyebath or, in those instances where the presence of strong alkali would cause damage to the fibre, from a dyebath containing sodium carbonate and sodium hydrosulphite (pH 7·5–8). The latter method is recommended when dyeing viscose rayon and provides a means whereby these dyes may be applied to mixtures of wool and cellulosic fibres, to nylon and to mixtures of nylon and cellulosic fibres. On nylon these dyes give dyeings of very good fastness to wet treatments and to hot pressing but their light fastness is inferior to that of dyeings of the same depth on cellulosic materials unless boiled in water or soap solution for 1–3 hr. As with the conventional sulphur dyes an aftertreatment of dyeings with acetic acid, potassium dichromate and copper sulphate, and sodium perborate may be given to improve either their brightness or fastness to light and wet treatments. In addition to being very suitable for package dyeing these dyes can also be applied to cloth by pad–jig development and pad–steam methods.

Sandoz Products Ltd.

ACID DYESTUFFS ON POLYAMIDE FIBRES— This card contains dyeings in two depths on nylon cloth of ninety-three acid dyes, nine Xylene Fast P dyes and sixteen Lanasyn and Lanasyn Brilliant dyes. The text includes notes on the effect of Lyogen P and Resoline NCP in improving the levelling properties of the dyes on "barry" nylon materials. The behaviour of each dye in presence of 2·5% of each of these reagents is tabulated.

LANASYN COLOURS ON WOOL PIECE— This card contains dyeings in three depths on wool cloth of twenty Lanasyn neutral-dyeing metal-complex dyes and five Lanasyn Brilliant dyes. In addition there are dyeings in five depths of thirty different two- and three-colour mixtures of them.

LANASYN AND LANASYN BRILLIANT COLOURS— This card contains dyeings in four depths on nylon cloth, in eight depths on wool cloth and in four depths on silk cloth of fifteen neutral dyeing premetallised dyes of the Lanasyn range and five compatible neutral dyeing acid dyes of the Lanasyn Brilliant series. In addition there are six sets of twelve dyeings on wool cloth demonstrating the use of Lanasyn dyes for producing browns and greys, Lanasyn Brown GRL and Grey 2BL being the two main components employed. The text includes details of the properties and use of Lyogen SMK, a new anionic levelling and restraining agent for use with this type of dye. The efficiency of this product for promoting penetration is illustrated by three photomicrographs of cross-sections of wool dyed in presence of ammonium sulphate, Glauber's salt, sodium acetate and acetic acid, and the latter plus Lyogen SMK, respectively.

DYEINGS ON "ACRILAN" SLIVER— This card contains dyeings on Acrilan sliver of twenty-nine chrome, fourteen Lanasyn, and eleven fast-to-milling acid dyes.

DYEINGS ON HEAT-TREATED POLYAMIDE FIBRES— This card contains dyeings on fabric knitted from Ban-Lon-nylon yarn of thirty-five acid dyes including members of the Xylene Fast P, Lanasyn Brilliant, and Brilliant Alizarin ranges. They have been produced by the Lyogen P method, which consists in pretreating the material with 5% of Lyogen P in presence of ammonium sulphate or acetic acid for 10 min. at the boil. The bath is then cooled to 140°F., the colour added and dyeing carried out in the usual way. With all the colours shown, all trouble due to "barriness" is overcome by this procedure and all the dyeings pass S.D.C. Mechanical Wash Test A. The Artisil disperse dyes are satisfactory for pastel colours. Since there is an increasing demand for fast dyeings on the nylon portion of nylon–Terylene mixtures, the Terylene to be left white, a range of eleven dyeings on Ban-Lon–nylon–Terylene knitted material are included.

HIGH-TEMPERATURE DYEINGS ON TERYLENE SLUBBING— This card contains dyeings on Terylene slubbing of six Artisil and two Foron disperse dyes together with two navies produced with Foron Brilliant Violet BL, Orange, GFL and Artisil Blue 4GP.

CUPROFIX BRILLIANT BLUE C–2BL— This direct dye gives bright reddish blues on cellulosic fibres when aftertreated with either copper sulphate or Cuprofix SL. Fastness figures for a dyeing aftertreated with copper sulphate include— Light 6, washing (60°C.) 4–5, perspiration 4–5.

LEUCOPHOR PA: DYED ON "BAN-LON" NYLON— This fluorescent brightening agent is particularly designed for use on polyamide fibres. It is normally applied in presence of 2–4% acetic (40%) acid at 90°C. for 20–30 min. and is characterised by good fastness to light, excellent fastness to washing and high stability to pleating. It is not stable to chlorite bleaching and a pretreatment with a reducing agent should be given to chlorite-bleached materials which are subsequently to be permanently pleated to ensure complete removal of chlorite before applying the Leucophor PA.

Abstracts from British and Foreign Journals and Patents

The titles of abstracts may be modified. Abbreviations of names of firms are listed in J.S.D.C., **68**, *23 (Jan. 1952) and also, together with symbols and the periodicals abstracted, in the annual index*

I—PLANT; MACHINERY; BUILDINGS

PATENTS

Furnace for Making Carbon Black (C.I. Pigment Black 6 and 7)
Godfrey L. Cabot *USP* 2,825,632–3

Pelleting of Carbon Black (C.I. Pigment Black 6 and 7)
Columbian Carbon Co. *USP* 2,828,191
Method and apparatus for producing pellets of increased bulk density which are readily dispersed in ink vehicles, etc. C.O.C.

Recycle Control for Carbon Black Pellet Mill
Phillips Petroleum Co. *USP* 2,828,190

Gas Lifting of Carbon Black Pellets
Phillips Petroleum Co. *USP* 2,837,415
Apparatus for separating Carbon Black pellets from the conveying gas in a pneumatic conveyor without cracking the pellets. C.O.C.

Treating Slivers and the like with Liquids
Barre Wool Combing Co. *USP* 2,831,747
Apparatus in which packages of sliver are treated with liquid while maintaining constant and minimum distances of liquid travel irrespective of the size of each package. There is low liquor to goods ratio. C.O.C.

Even Piling of Open-width Fabric into a J-Box
DuP *USP* 2,825,556

Dyeing or Other Wet Processing of Textiles
B. F. H. Mellbin *BP* 804,259
The material is impregnated with the treating liquor and then passed into a chamber where it can be kept hot and moist. This chamber is a separate unit which can be moved so as to be readily brought into position for receiving the material immediately after its impregnation and then readily removed with the material in it. C.O.C.

Continuous Bleaching
Deutsche Gold- und Silber-Scheideanstalt vormals Roessler *BP* 803,304
The materials pass through a liquor containing per compounds or chlorites and then through a long heating chamber which has heating devices arranged at intervals along the path of travel of the material and finally through a chamber insulated against loss of heat. The heating devices can have their temperatures individually adjusted. C.O.C.

Applying Liquid to Textiles
Calico Printers' Assocn. *BP* 803,453
The textile is passed through the nip formed by an engraved roller to which the liquid is applied and a roller covered with resilient material. A second roller covered with resilient material contacts the engraved roller between the point of application of the liquid and the nip. By varying the pressure of this second roller against the engraved roller the amount of liquid retained by the engraving, and so that applied to the textile, may be varied over a wide range. C.O.C.

Apparatus for Extracting Water from and Impregnating Tubular Fabric
Samcoe Holding Corpn. *USP* 2,826,167

Mounting Fabric on Pin Chains of Tenters
Vits-Elektro *USP* 2,831,234

High Speed Festoon of Fabric or Paper during Ageing or Drying
Eastman Kodak Co. *USP* 2,831,677

Apparatus for Dyeing Leather Lacing
R. W. Scott *USP* 2,836,048
Apparatus for continuously dyeing leather lacing, the dye being applied only to the reverse side and edges of the lacing. C.O.C.

Baking Machine for Cloth, Paper, etc.
Industrial Ovens *USP* 2,837,834

Apparatus which enables very precise and responsive temperature control of the treated material despite rapid fluctuation of such conditions as speed of the material, temperature, and humidity of the material as it enters, and ambient air temperature and humidity. C.O.C.

Hosiery Boarding Apparatus
F. M. Southerland and W. E. Rascoe *USP* 2,837,832

An infrared movable boarding member or former for use in machines of the type described in *USP* 2,745,191 in which the formers are mounted on a wheel which rotates to allow them to be in suitable heating zones for described lengths of time. C.O.C.

Improving the Stability of Suspensions or Emulsions (III this page)

II—WATER AND EFFLUENTS

PATENT

Combined Ion Exchange and Electrolytic Treatment of Boiler Feed Water
R. E. Briggs *USP* 2,838,449

A method specially suited for waters of low carbonate hardness but high non-carbonate hardness and also for waters of low alkali metal content. C.O.C.

III—CHEMICALS; AUXILIARY PRODUCTS; FINISHING MATERIALS

Progress in the Chemistry of Organic Fluorine Compounds
G. Oláh and A. Parláth

Vegipari Kutató Intézetek Közleményei **4**, 48–67 (1954); *Chem. Abs.*, **52**, 16181 (10 Oct. 1958)

Derivatives of *p*-F·C_6H_4·CHO are useful as dyeing assistants. C.O.C.

PATENTS

Non-ionic Surfactants
Petrolite Corpn. *USP* 2,839,476–7

Surface-active products are obtained by treating a glycol in which one hydroxy group is tertiary and the other primary or secondary and which may have been condensed with $\gg$ 4 mol. of ethylene oxide, with propylene or butylene oxide and then with ethylene oxide. 2-Methyl-2:4-pentane diol used as the starting material yields an unusually satisfactory surfactant. C.O.C.

Detergent
Colgate-Palmolive Co. *USP* 2,831,815

Addition of higher fatty acyl dialkylolamides, preferably those of formula R^1·CO·NR^2R^3(R^1·CO = acyl of 10–16 C; R^2 and R^3 = same or different hydroxy alkyl of $<$ 6 C), e.g. *NN*-bis(2-hydroxyethyl) lauramide, to water-soluble non-ionic aliphatic detergents much enhances the detergent action. C.O.C.

Detergent
DuP *USP* 2,833,722

A detergent which produces and maintains copious foam in presence of grease and is well able to emulsify greasy dirt and hold it in suspension consists of a mono-*n*-dodecyl sulphate and 10–30% by weight on the mixture of a compound of formula R·NH·CH_2·CH_2·CO·OX (R = *n* Alk of 10–12 C; X = water-solubilising cation), e.g. decyl or dodecyl-*β*-alanine. C.O.C.

Emulsifying Agent
C. E. Maher *USP* 2,826,596

Heating a mixture of (1) keryl, hexyl, octyl, nonyl, and dodecyl monocyclic aryl sulphonic and phosphonic acids, or an acid sulphate of a hydroxylated higher fatty acid or alcohol, or octyl 1–2 acid phosphonate and nonyl phosphonic acid, (2) a higher fatty acid, and (3) a mono- or di-alkanol amine, at 120–180°C. long enough to produce a sulpho- or phosphoamide of the ester of the fatty acid and the alcohol, yields a liquid soluble in petrol and paraffin and useful as an emulsifying agent producing oil-in-water emulsions. C.O.C.

Modified Starch Size
Standard Brands *USP* 2,831,853

Size suitable for either natural or man-made fibres is obtained by forming a 5–24°Bé aqueous slurry of starch and treating it with 10% (on the dry weight of starch) of gluconic acid or δ-gluconolactone at $\gg$ 140°F. in presence of nitric, sulphuric, phosphoric or hydrochloric acid as catalyst. The treated slurry is used directly as a size. C.O.C.

Thick-pasting Starch containing a Water-soluble Urea–Formaldehyde Condensate
A. E. Staley Manufacturing Co. *USP* 2,838,465

A product which cooks rapidly and equally well in water at pH 4–10 to yield a high viscosity paste having excellent high viscosity stability for a long time is obtained by treating unmodified starch with a little of a water-soluble, heat-reactive urea–formaldehyde condensate, e.g. mono-ethyl urea and dimethylolurea. C.O.C.

Solubilising Mineral, Vegetable or Animal Oils in C_1-C_6 Monohydric Aliphatic Alcohols
I. L. Lubowe *BP* 803,545

Oils are made miscible with C_1–C_6 monohydric aliphatic alcohols by mixing them with a C_1–C_3 aliphatic ester of a C_{10}–C_{24} fatty acid. Thus paraffin and alcohol are miscible when mixed with a 50/50 mixture of *iso*propyl laurate and myristate. C.O.C.

Improving the Stability of Suspensions or Emulsions
Torrance & Sons *BP* 804,317

The dispersion or emulsion is subjected to the action of a low-voltage alternating or pulsating current passing between one or more pairs of opposed electrodes, there being $\gg$ 0·010 in. between the electrodes of each pair, it being preferable that they shall touch over a very small area. C.O.C.

Antistatic Agent
American Cyanamid Co. *USP* 2,836,517

Compounds of formula R^1·CO·NH·$(CH_2)_3$·$NYR^2R^3R^4$ or R^1·CO·NH·$(CH_2)_3$·$N^+R^2R^3R^4\}Y^-$ (R^1 = aliphatic or alicyclic hydrocarbon of $>$ 6 C; R^2 = $-(C_nH_{2n}O)_mH$ (*n* = 2, 3 or 4, *m* $>$ 5); R^3 = Alk or hydroxyalkyl or 1–5 C or R^1; R^4 = H or R^2; Y = anion) are good antistatic agents. Thus γ-stearamidopropyldimethylnonaethenoxyammonium chloride applied to acrylic fibre yields an antistatic finish of good fastness to repeated washing. C.O.C.

Polymers useful as Antistatic Coatings
DuP *BP* 804,069

Water-soluble addition copolymers of a quaternary ammonium salt of an acrylic ester or of an α-hydrocarbon substituted acrylic ester or an amino alcohol (whose amine N atom is tertiary) and an ethylenically unsaturated aliphatic ether or ester containing an epoxide group yield films which on heating at $\gg$ 120°C. become insoluble and possess antistatic properties. They are also useful as mordants for acid dyes. C.O.C.

Antistatic Size
Davies-Young Soap Co. *USP* 2,826,506

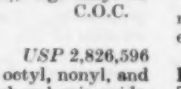
A dispersion or solution of size containing an antistatic agent is used. Thus a dispersion of, by weight, 5–40% gum arabic and 5–40% [alkyl(C_8–C_{12})-butylmethyl]-trimethyl-ammonium chloride is especially suitable for treating garments after they have been dry cleaned or dyed. C.O.C.

Antistatic Finish
Monsanto *USP* 2,837,446

Quaternary phosphonium salts, e.g. benzyl tris(dimethylamino) phosphonium chloride, are particularly effective antistatic agents for synthetic polymers. C.O.C.

Foaming Bleach containing Betaines
Texize Chemicals *USP* 2,834,737

Sodium hypochlorite solutions are given foaming and penetrating powers by presence of compounds of formula—



(R = long chain Alk of 10–16 C), e.g. C-decyl-*N*-trimethyl-α-betaine. C.O.C.

Antistatic Agents for Hydrophobic Fibres
DuP *USP* 2,839,430

Antistatic agents of excellent initial strength and of satisfactory durability to washing and dry cleaning are obtained by polymerising monalkoxy polyethylene glycol acylates of formula—

$$CH_2{:}CR^1{\cdot}CO{\cdot}(OCH_2CH_2)_n{\cdot}OR^2$$

(R^1 = H or CH_3; R^2 = Alk of 1–6 C; n = 4–20) with an acylamide of formula $CH_2{:}CR^1{\cdot}CO{\cdot}NHR^3$ (R^3 = H, CH_2OH, $CH_2{\cdot}OCH_3$ or $CH_2{\cdot}OC_2H_5$). Thus the methoxy polyethylene glycol acylate obtained from methoxy polyethylene glycol "550" and methyl acrylate was polymerised with acrylamide to give an antistatic agent which in polyester fibres gives a finish which is very good after five soapings at 160°F.

USP 2,839,431

Glycidyl methacrylate

$$CH_2{:}CCH_3{\cdot}CO{\cdot}O{\cdot}CH_2{\cdot}CH\text{—}CH_2$$
$$\qquad\qquad\qquad\qquad\qquad\qquad\quad \backslash O /$$

is used instead of an acrylamide. C.O.C.

Soap-miscible Hypochlorite Bleaching Composition
Olin Mathieson Chemical Corpn. *USP* 2,829,110

Addition of finely ground, anhydrous crystalline $CaCO_3$ to calcium hypochlorite–soda ash compositions facilitates their reaction in water to produce aqueous NaOCl which does not react with soap even if added to soap solution immediately after its preparation. C.O.C.

Aqueous Dispersions of Cyanoethylated Starch and Acetonitrile as Finishes for Cellulosic Materials
Monsanto *USP* 2,836,511

Cyanoethyl ethers of starch containing 1·5–2·0 cyanoethyl groups per glucose unit are readily dispersed in acetonitrile containing 2–54% by weight of water. The critical factor is the ratio of water to acetonitrile and not the amount of cyanoethylated starch. As the degree of substitution in the starch increases, both the minimum limits of water in the water–acetonitrile mixture decrease. These dispersions can be used as finishes for cellulose materials to which they impart resistance to water, solvents and micro-organisms. They are particularly suitable for impregnating cotton cloth to produce tracing cloth. C.O.C.

Colloidal Solutions of Cyanoethyl Ethers of Starch in Dimethyl Sulphoxide for Finishing Cellulosic Materials
Monsanto *USP* 2,836,512

Cyanoethyl ethers of starch containing 1·5–2·0 cyanoethyl ether groups per glucose unit form colloidal solutions in dimethyl sulphoxide in presence or absence of water. The maximum amount of water that may be present varies from 25% for starch containing 2 cyanoethyl ether groups per glucose unit to 30% for starch containing 1·5 cyanoethyl ether groups. Such solutions are used for finishing cellulosic materials to which they impart resistance to water, solvents, and micro-organisms. They are particularly suitable for finishing tracing cloth, hollands, etc. C.O.C.

Aqueous Colloidal Systems of Cyanoethylated Starch and Aliphatic Ketones for Improving the Resistance of Cellulosic Materials to Water, Solvents, and Micro-organisms
Monsanto *USP* 2,837,438

A colloidal sol is obtained by dispersing a cyanoethyl ether of starch containing 1·5–2·0 cyanoethyl ether groups per glucose unit in a solvent mixture of water and a low mol.wt. aliphatic ketone, e.g. acetone. The amount of water present varies from 1–49% of the solvent mixture for starch containing 2 cyanoethyl groups per glucose unit and 12–55% for starch containing 1·5 cyanoethyl groups per glucose unit. The sol is used to render cellulosic materials less susceptible to deterioration by water, solvents, and micro-organisms. C.O.C.

Stable Resin Finish
DuP *USP* 2,825,710

If di(methoxymethyl)-urea is treated with HCHO at pH 8–10 and 55–65°C., the resultant water-soluble product can be recovered as a 50–70% aqueous solution which is very stable to prolonged storage and is readily diluted with water to a 2–5% solution. C.O.C.

Hydrophilic Thiourea–Aldehyde Resins for Producing Flame-retarding Finishes on Nylon and as Finishing agents for Other Fibres and Paper
American Cyanamid Co. *BP* 804,291

A water-soluble aldehyde (1·0–2·3 mol.) is condensed with thiourea (1) and the condensate (1) treated with a water-soluble aliphatic monohydric alcohol ($<$ 0·4 mol.) at 45–65°C. and pH 4·5–5·6, the reaction being stopped before a sample yields a precipitate on dilution with 50 volumes of water at 20°C. The products have varied uses in paper making, textile finishing, etc. but are particularly useful for producing a durable flame-retardant stiff finish on open mesh fabrics containing 20% or more by weight of nylon. They do not impart a flame-retardant finish to any fibres except nylon. C.O.C.

Magnesium Chloride as the Sole Curing Agent for Aminotriazine–Aldehyde Resins: Antistatic Finish on Hydrophobic Fibres
American Cyanamid Co. *USP* 2,839,506

When magnesium chloride is used as the sole curing agent for an aminotriazine–aldehyde resin, e.g. for methylated trimethylol melamine, an enhanced degree of crease recovery is obtained together with excellent dimensional stabilisation, and lessened chlorine absorption. Such resin-catalyst combinations applied to hydrophobic fibres e.g. nylon, impart an antistatic finish. C.O.C.

Epoxy Resin Finish
Bates Manufacturing Co. *USP* 2,829,072

Peroxy halogenides of a metal other than an alkali or alkali earth metal are good curing catalysts for epoxy resin precondensates and their use in epoxy resin finishes applied to textiles results in increased ability to recover from creasing, dimensional stability, speed of drying, and improved handle and draping qualities. Thus cotton cloth is impregnated with an aqueous dispersion containing Epon S22 (Shell Oil Co.), softening agent, surface active agent, polyvinyl alcohol, and Zn perchlorate, dried for 150 sec. at 240°F. and baked for 60 sec. at 325°F., scoured and air dried. C.O.C.

Organopolysiloxanes for Water-repellent Textiles
Wacker-Chemie *BP* 804,162

Mixtures of organopolysiloxane oils and organopolysiloxane resins dissolved in organic solvents are excellent impregnating agents for textiles made up of natural or man-made fibres if there is added to the siloxane mixtures a compound of Ti or Zr with a keto-enoltautomeric aliphatic compound whose enolic form can form complexes with these metals. Thus acetate rayon fabric was impregnated with a benzine solution containing mono- and dimethyl polysiloxane resins, Ti enolate of acetoacetic acid, and dimethyl polysiloxane oil, and cured for 25 min. at 90°C. This gave a water-repellent finish fast to repeated laundering and dry-cleaning. The treated fabric had a soft pleasant handle. C.O.C.

Dispersions of Alkoxy Aluminium Chelates as Water-repellent Agents
DuP *USP* 2,839,421

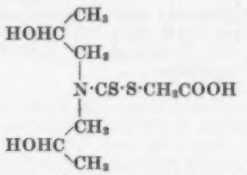
Compounds of average formula $Al(R^1)_x(OR^2)_y$ (R^1 = anion of a bidentate chelating agent containing an alkyl chain of $>$ 11 C and one acidic H atom; x and y each $=$ $<$ 0·5 and $x + y = 3$) are used as water-repellent agents for textiles, leather, paper, in paints, etc. Thus distearin (156 g.) in toluene was refluxed with ethyl acetoacetate under a precision still. Ethanol (11 g.) was removed overhead as a toluene/ethanol binary. Aluminium *iso*propoxide (35 g.) was added and distillation continued to remove the *iso*propyl alcohol formed as the toluene/alcohol binary. Removal of the toluene left a yellow wax of composition (octadecyl benzoylaceto)$_{2\cdot3}$ aluminium (*iso*propoxide)$_{0\cdot7}$. Cotton sheeting impregnated with a toluene solution of this chelate, so as to obtain a dry increase in weight of 8·2%, and air-dried, remained unaltered in appearance and handle but had a water-repellent finish which resisted soaping at the boil. C.O.C.

1:3-Dithiolanes as Fungicides and Antioxidants
DuP *USP* 2,839,445

1:3-Dithiolanes and substituted 1:3-dithiolanes having at position 2- or 4- a carboxyl acid side chain in which the carboxyl group is separated from the ring by a saturated aliphatic hydrocarbon chain, e.g. 2-(4-carboxybutyl)-1:3-dithiolane, have good fungicidal and antioxidant properties. C.O.C.

Dithiocarbamate Derivatives for use in Permanent Waving
van Ameringen–Haebler *BP* 804,077

The compounds obtained by treating an aliphatic amino alcohol with CS_2 and a halogenated aliphatic monocarboxylic acid by the method described in *BP* 771,627 (J.S.D.C., **73**, 334 (1957)) e.g.



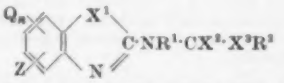
obtained by reacting di*iso*propanolamine, CS_2 and monochloracetic acid, are used as waving lotions. C.O.C.

Stable Dispersions of at least Two Metal or Metallised Oxides
Deutsche Gold- und Silber-Scheideanstalt vormals Roessler *BP* 804,140

Stable dispersions of a mixed oxide can be obtained if a little of a phosphate and/or an alkali metal silicate is present. The mixed oxide should have been formed as an aerosol by thermal decomposition of the vapours of mixed metal or metallised halides in presence of hydrogen or hydrogen and oxygen, recovered as an aerogel and dispersed in the liquid in that form. The product have very varied uses, e.g. as antislip finishes or weighting agents. C.O.C.

Fungicides
DuP *USP* 2,833,689

Compounds of formula—



(X^1, X^2 and X^3 = same or different, O or S; R^1 = H or Alk of < 5C; R^2 = aliphatic hydrocarbon of < 5C; Q = Hal; Z = H or NO_2; n = 0, 1 or 2), e.g. 2-benzothiazole carbamic acid methyl ester, are extremely effective fungicides. They are solids and may be applied to textiles, leather, paints, etc. C.O.C.

Rotproofing Agents
Gy *BP* 804,186

Compounds of formula $R^1{\cdot}X{\cdot}R^2{\cdot}CO{\cdot}NR^3{\cdot}CH_2{\cdot}CH_2{\cdot}OH$ (R^1 = aliphatic hydrocarbon chain of > 7C which may be interrupted by O or S; R^2 = alkylene of < 4C; R^3 = H, CH_3 or hydroxyethyl; X = O or S) are strongly antiseptic. Thus cotton cloth treated with decyloxyacetic acid monethanolamide is resistant to attack by fungi. C.O.C.

Plastisols for producing Water Vapour Permeable Coated Fabrics, Cast Films, etc.
DuP *USP* 2,825,711

A dry blend of particulate water-insoluble non-electrolyte film-forming polymer and a particulate anionic polyelectrolyte polymer containing oxirane or 1:2-epoxy groups is dispersed in a liquid organic plasticiser at room temperature. The product is used for coating fabrics, forming films, etc. C.O.C.

Liquid Rosin Sizes containing Anti-stratifying and Viscosity Decreasing Agent
American Cyanamid Co. *USP* 2,832,692

Liquid rosin sizes formed by treating rosin with hot aqueous alkali have their viscosity decreased and stratification prevented by adding 0·5–6·0% Na acetate on the dry contents of the size.

USP 2,832,693

The same effect is obtained by addition of 0·5–6·0% of an alkali metal nitrate. C.O.C.

Colourless Aqueous Saline Solutions of Polyacrylonitrile
Dow Chemical Co. *USP* 2,837,492

Development of yellow to brown discoloration in solutions of acrylonitrile polymers in aqueous zinc chloride is inhibited by acidifying the solution until the pH is below that of zinc chloride alone at the concentration employed. C.O.C.

Rodent Repellents
Sun Oil Co. *USP* 2,832,714

Materials, e.g. fabric or paper, impregnated with a naphthenylamine or its acid salt, e.g. the hydrochloric or picric acid salt of naphthenyl amines of mol.wt. 294, are repellent to rodents and can be used as packaging materials to protect food, etc.

USP 2,832,715

2-Naphthenyl imidazolines and 2-naphthenyl benzimidazolines are particularly effective as rodent repellents. C.O.C.

Complexone-type Metallochromic Indicators (IV p. 63)
Indophenol Complexones—A New Group of Metallochromic Indicators (IV p. 63)

IV—RAW MATERIALS; INTERMEDIATES; COLOURING MATTERS

Colour Theory of Organic Substances
V. A. Izmail'skii

Khim. Nauka i Prom., **3**, 232–248 (1958): *Chem. Abs.* **52**, 16745 (10 Oct. 1958)

Discussion of the relationship between spectra and structure of organic dyes. C.O.C.

Dipole Influences in Aromatic Substitution
P. R. Wells and E. R. Ward

Chem. and Ind., 1172–1173 (6 Sept. 1958)

The relatively large amount of *o*-substitution observed when the nucleus contains *meta*-directing dipolar groups (e.g. with benzaldehyde and nitrobenzene), are explained by Hammond as due to a reduction of *ortho*-deactivation owing to a favourable orientation of the substituent dipole. The authors have found that certain features of the same type occur in electrophilic substitution in naphthalene deriv., which seem best explained by Hammond's hypothesis, and examples cited are the unexpected high reactivity of the 8-position in nitronaphthalenes, the predominant 4-nitration of 1:5-dinitronaphthalene in H_2SO_4 medium where 3-nitration would be expected, the 1- and 4-nitration of the *O-m*-nitrobenzenesulphonyl deriv. of 5-nitro-2-naphthol, contrasting with the 8-nitro-isomer which reacts in the 1-position only, and the 8-nitration of 1-nitro-2-methylnaphthalene in which bromination occurs at 5-position. H.H.H.

Nitration with Acids consisting of Nitric Acid and Sulphur Trioxide
P. M. Heertjes

Rec. Trav. chim., **77**, 693–713 (Aug. 1958)

The nitrating powers of mixed acids consisting of HNO_3 and SO_3 compared with those of HNO_3 and H_2SO_4 have been investigated on three examples, viz., the easy nitration of *p*-chloronitrobenzene to 1-chloro-2:4-dinitrobenzene, the difficult nitration of the latter to 1-chloro-2:4:6-trinitrobenzene, and the relatively easy nitration of 2:4-dinitrotoluene to 2:4:6-trinitrotoluene in which oxidation can be rather marked. The experiments were carried out batch-wise and continuously. It is concluded that the HNO_3–SO_3 acids with 40–72% SO_3 are good nitrating acids; for difficult nitrations, acid with $\sim$ 70% SO_3 shows a definite advantage over acids of HNO_3 and H_2SO_4. For acids with $\sim$ 45% SO_3, which in view of their thermal stability can only be used for relatively easy nitrations, the difference is small between the two acid types, although the advantage of the better SO_3 economy with the HNO_3–SO_3 acids is always present. H.H.H.

Hydrogen Bonding in *o*-Nitrophenol in Presence of *p*-Nitrophenol
S. M. Deshpande and N. V. Parthasarathy

J. Indian Chem. Soc., **35**, 399–406 (June 1958)

Polarograms of *o*- and *p*-nitrophenol, both singly and in admixture, within the pH range 1·0–10·2, have been studied; these consist of single waves of similar pattern and have a residual current region. The wave height increases gradually when one isomer is added progressively to the other, though always to a height less than the sum of the two component values, and this indicates the mutual influence of the isomers in admixture. The influence of the *o*- over the *p*-isomer is less than the reverse. The stability of the H-bonding in *o*-nitrophenol varies with the proportional amount of *p*-isomer present. The *p*-opd. destabilises the H-bonding in the *o*-isomer. J.W.D.

Syntheses and Properties of Aromatic Nitroso Compounds
W. J. Mijs, S. E. Hoekstra, R. M. Ulmann, and E. Havinga
Rec. Trav. Chim., **77**, 746–752 (Aug. 1958)

Measurements of spectra in the visible region at different concn. and temp. for 17 aromatic nitroso cpd. are reported; their syntheses are also described. The relationship between steric inhibition of resonance and the tendency of nitroso cpd. to form dimers is discussed. It is found that the tendency to dimerisation is low in cases of strong resonance interaction between the nitroso group and the aromatic system; also that the monomer–dimer equilibrium is shifted in favour of the monomeric species in a polar solvent such as nitrobenzene. In the solid state, mol. in which a strong resonance may theoretically be expected (e.g. by the presence of electron-donating groups in the *para* position) form green, relatively low melting crystals consisting of monomeric mol.; their deriv. having bulky *ortho* substituents are colourless, show higher m.p. and appear to be built up from dimeric mol. H.H.H.

Intramolecular Hydrogen Bonding in *o*-Nitro-aniline
T. Urbanski and U. Dabrowska
Chem. and Ind., 1206 (13 Sept. 1958)

From an examination of the infrared absorption spectra of *o*- *m*- and *p*-nitroanilines in carbon tetrachloride (0·05% soln.) it was found that the frequencies of the nitro group symmetric vibrations agree with data for a free, unbonded nitro group. Thus no evidence exists for a hydrogen bond between the amino and nitro groups of *o*-nitroaniline.
H.H.H.

Colour Phenomena in Diacyl Derivatives of *p*-Aminophenol
E. A. Smirnov
Doklady Akad. Nauk S.S.S.R., **120**, 544–547 (21 May 1958)

The colour of two series of diacylated derivatives of *p*-aminophenol in the solid state obtained by (*a*) forming the benzoate or trimethylgallate and converting the NH_2 group into the amide of either *p*-nitro-, or 3:5-dinitro-benzoic acid, and (*b*) by reversing the acylating agents for the OH– and NH_2– groups respectively, is investigated. It is shown that compounds of this type are capable of existing in two slightly differently coloured forms when the acylating agent is trimethylgallic acid as distinct from benzoic acid; the two forms being obtained by crystallisation from the appropriate solvents. The trimethylgallic acid derivative exhibits a weaker colour than that of the corresponding benzoic acid derivative. The author explains these colour phenomena on the basis of the degree of interaction of the three different contributing chromophoric systems in these compounds. G.J.K.

Colour Isomerism and Structure of Some Copper Co-ordination Compounds
T. N. Waters, D. Hall, and F. J. Llewellyn
Chem. and Ind., 1203–1204 (13 Sept. 1958)

From an examination of a number of copper complexes of salicylaldehyde, 2-hydroxy-1-naphthaldehyde, and their deriv. by electronic absorption spectra, magnetic susceptibility, and X-ray diffraction analysis, evidence was furnished that the colour isomerism displayed by this type of complex depends upon whether or not co-ordination occurs in the octahedral positions of the copper atom. It also suggests that the possibility of intermol. bonding in cpd. expected to show formal four covalence should be considered when making deductions from magnetic and spectral data. It is, for instance, not improbable that some flat-square nickel–salicylaldehyde complexes possess intermol. co-ordination. H.H.H.

Chemical Structure of Hydrochlorides of Aminoazo Dyes from their Infrared Spectra
D. N. Shigorin and G. D. Bagratishvili
Optika i Spektroskopiya **4**, 274–8 (1958): *Chem. Abs.*, **52**, 15248 (25 Sept. 1958)

The infrared absorption spectra in the range 2·5–5·0 μ. were determined for the hydrochlorides of *p*-aminoazobenzene, 1-amino-4-phenylazonaphthalene and 2-amino-1-phenylazonaphthalene. Analysis of the spectra and other properties of these compounds indicates that *o*- and *p*-aminoazo compounds exist only in the azo form and not as a tautomeric equilibrium mixture of azo and quinone imide forms. C.O.C.

New Approaches in the Synthesis of Direct Dyes
V. N. Vertkina, M. S. Dinaburg, R. F. Mazel, K. Y. Mar'yanovskaya, B. A. Poral-Koshits, K. E. Ul'man, and L. S. Efros
Khim. Nauka i Prom. **3**, 191-212 (1958): *Chem. Abs.*, **52**, 16745 (10 Oct. 1958)

Review, 241 references. C.O.C.

Arylation of Quinones with Diazonium Salts. IV—Reaction of these Salts with 2:5-Dihydroxy-*p*-benzoquinone and the Synthesis of 3-Hydroxy-2:5-bisphenyl-*p*-benzoquinone
P. Brassard and P. L'Écuyer
Canadian J. Chem., **36**, 1346–1349 (Oct. 1938)

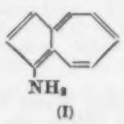
The accumulation of phenolic functions on the ring of *p*-benzoquinone causes the mol. to favour coupling with diazonium salts at the expense of arylation. The reaction of 2:5-dihydroxy-*p*-benzoquinone with these salts, and in presence of a 25% mol. excess of potassium hydroxide, affords 2:5-dihydroxy-3-phenylazo-*p*-benzoquinone; when the reaction is carried out, however, with twice the calculated amount of base, the product formed is 2:5-dihydroxy-3-phenyl-6-phenylazo-*p*-benzoquinone. The 2:5-dihydroxy-3:6-bis-*o*-tolyl-*p*-benzoquinone is the only 2:5-dihydroxy-3:6-bisaryl-*p*-benzoquinone which the authors could synthesise by this reaction, although the 3-hydroxy-2:5-bisphenyl-*p*-benzoquinone has been prepared by another procedure now described. H.H.H.

General Base Catalysis of Orientation in Coupling of Resorcinol
H. F. Hodson, O. A. Stamm, and H. Zollinger
Helv. chim. Acta., **41**, 1816–1823 (Oct. 1958)

Diazo coupling of 4-phenylazoresorcinol is found to occur in the 2 or 6 position depending on the acidity of the medium. This orientation phenomenon is shown to be due to general base and not to hydroxyl ion catalysis. Diazo orientation in resorcinol and in *m*-phenylenediamine couplings probably has the same mechanistic basis as in those of *α*-naphthol. H.H.H.

Basicity and Absorption Spectra of 1-Aminoazulene
J. Schulze and E. Heilbronner
Helv. Chim. Acta, **41**, 1492–1500 (Oct. 1958)

1-Aminoazulene (I) is prepared in pure condition by coupling azulene with sulphanilic acid and reducing the 1-*p*-sulphophenylazo-azulene formed with sodium hydrosulphite in alkaline medium. Its absorption spectrum and that of its conjugate acid in *cyclo*hexane and in formic acid are recorded, and its apparent p*K* (4·3) is compared with that of aniline (3·7), *α*-naphthylamine (3·1), and *β*-naphthylamine (4·3).



(I)

H.H.H.

Electronic Structure and Physicochemical Properties of Azo Compounds

I—Arylazoazulene and Arylazoguaiazulene
F. Gerson and E. Heilbronner
Helv. chim. Acta, **41**, 1444–1463 (Oct. 1958)

The preparations of arylazo- and arylazo-guaiazulenes are described (with aryl = phenyl, *α*-naphthyl, *β*-naphthyl, *α*-anthryl, and *β*-anthryl), and their absorption spectra and basicities recorded.

II—Substituted Phenylazoazulenes
F. Gerson, J. Schulze, and E. Heilbronner
Ibid., 1463–1481

Similar data for substituted phenylazoazulenes are recorded.

III—Dipole Moments of Substituted Phenylazoazulenes
F. Gerson, T. Gäumann, and E. Heilbronner
Ibid., 1481–1491

The dipole moments in benzene for the compounds described in I and II are given, and a discussion of them, under the assumption that partial moments add vectorially, suggests that phenylazoazulene has the *trans* configuration with the azulene nucleus in the *s-trans* constellation relative to the azo bond. H.H.H.

Preparation and Metal-complexing Properties of 2-Salicylideneimino-4:6-diamino-1:3:5-triazine
Q. Fernando and H. Freiser
Chem. and Ind., 1230–1231 (20 Sept. 1958)

The title substance (I) was prepared by heating melamine (II) with excess of salicylaldehyde (III) until a reaction occurred, and a yellowish brown solid was formed, which was established by X-ray diffraction and infrared spectra and by its acid dissociation constant as a condensation product of equimol. quantities of II and III to form the corresponding azomethine. I showed selective chelating properties, viz., with Cu (green), Co (green), Fe (purple), U (orange yellow), and colourless chelates with Ni, Zn, and Cd. Chelation was found to be dependent on pH and metal ion separations were as follows: Fe at 2·5, Cu at 4·0, Co and U at 8·5 (i.e. in alkaline soln.). Examples are given to show the efficiency and rapidity of the metal separations effected. H.H.H.

Complex Formation between Uranyl and 1-Hydroxy-2-naphthoic Acid— A Potentiometric, Colorimetric, and Conductometric Study
S. C. Tripathi and S. Prakash
Research J. Hindi Science Academy, **1**, (1), 1–11 (1958)

Hydroxynaphthoic acids serve as good chelating agents. The complex formation of uranyl with 1-hydroxy-2-naphthoic acid has been studied by physical methods. The fall in pH of monosodium 1-hydroxy-2-naphthoate on the addition of uranyl nitrate shows the liberation of hydroxyl hydrogen in the process of formation of some complex. The formation of a red-coloured 1:1 complex at pH 4·8 is demonstrated by the inflection at one equivalent of alkali in all the potentiometric titration curves of different mixtures of uranyl nitrate and the monosodium salt, by a maximum in the colorimeter readings, and by a break in the specific conductivity curves. C.J.W.H.

Complexone-type Metallochromic Indicators
J. Körbl, V. Svoboda, and D. Terzijská
Chem. and Ind., 1232–1233 (20 Sept. 1958)

New condensation products which are metallochromic indicators are prepared by the method previously described (Körbl, *Chem. Listy*, **51**, 1304 (1957); *Coll. Czech. Chem. Commun.*, **22**, 1789 (1957)) from iminodiacetic acid with formaldehyde and rosolic acid, Pyrocatechol Violet, and Pyrogallol Red; also new condensation products from Cresol Red with formaldehyde and α-alanine, α-amino-n-butyric acid, norvaline, and valine by Schwarzenbach's procedure (*Helv. chim. Acta*, **37**, 113 (1954)). In addition, two series have been obtained by the condensation of sulphonphthalein dyes with formaldehyde and with either ββ-iminodipropionic acid (IDP) and with *N*-β-carboxyethylglycine (IPA), and names for these indicators such as IDP–Thymol Blue and IPA–Xylenol Blue are suggested. It is found that all types of metallochromic indicators hitherto prepared can be arranged into a sequence in terms of the imino acids used, in which, in general, the metallochromic properties gradually disappear, viz., iminodiacetic acid > IPA ⩾ glycine and other α-amino acids = IDP > β-alanine. H.H.H.

Syntheses of Diphenylamine Blue and its Sulphonation Products
R. Asaoka and T. Sekiguchi
Rept. Govt. Chem. Ind. Research Inst. Tokyo, **53**, 179–184 (xix) (May 1958)

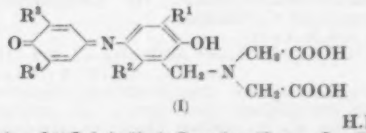
Diphenylamine Blue (I) was prepared by fusing a mixture of diphenylamine (1 part) and oxalic acid (4 parts) at 125–130°c. for 9 hr. in the presence of chromic anhydride (30–40% of diphenylamine) which was added 6 hr. after the reaction had commenced. Sulphonation of I to Alkali Blue (II) was carried out by heating it for 4 hr. with H_2SO_4 (*d* 1·84; 6 parts) at 30–35°c., and to Water Blue (III) for 6 hr. at 90–100°c. with H_2SO_4 (*d* 1·84; 8 parts). II was obtained as the free acid and III as the ammonium salt. H.H.H.

Absorption Spectrum of Benzoquinone
R. S. Singh
Research J. Hindi Science Academy, **1**, (1), 13–14 (1958)

The absorption spectrum of benzoquinone in the vapour state was photographed under different conditions of temperature and cell lengths. Two band systems in the ultraviolet and one in the visible were developed and analysed. C.J.W.H.

Indophenol Complexones— A New Group of Metallochromic Indicators
J. Körbl and V. Svoboda
Chem. and Ind., 1233–1234 (20 Sept. 1958)

Attempts have failed to condense directly the indophenol dyes with formaldehyde and iminodiacetic acid by any previous procedure, owing to the low stability of the dyes under the conditions employed. However, syntheses have been accomplished either by treatment of the previously prepared (and possibly further substituted) *o*-dicarboxymethylaminomethylphenols with 2:6-dihalogeno-*p*-quinonechlorimines in alkaline soln., or by oxidation of a mixture of these phenols with 2:6-dihalogeno-4-aminophenols with sodium hypochlorite. The cpd. have the general formula (I) and have been isolated in the form of sodium salts forming violet, blue, green, or black microcryst. materials readily sol. in water. Aq. soln. are orange–yellow to crimson red, but at pH 4–6, they turn intense blue and are very stable when alkaline. At ~ pH 3·5 all the new cpd. form intense violet or blue complexes with many ions, e.g. Zr^{4+}, Bi^{3+}, Th^{4+}, Sc^{3+}, Fe^{3+}, and Al^{3+}. In alkaline soln. these indophenol complexones form greenish-blue complexes with alkaline-earth metal ions and some of the heavy-metal ions.



(I)

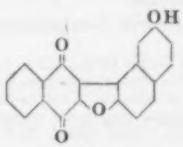
H.H.H.

Synthesis of ^{14}C-labelled Cyanine Dyes. I— Formation Mechanism of *meso*Methyltrimethinthiacyanine by 2-Methylbenzothiazole ethiodide-2-^{14}C
K. Taki and Y. Hishiki
Kagaku Kenkyusho Hokoku, **33**, 350–352 (1957): *Chem. Abs.*, **52**, 16334 (10 Oct. 1958)

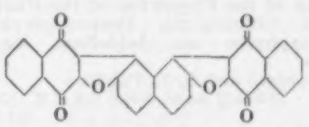
*meso*Methyltrimethinthiacyanine is formed when 2-methylbenzothiazole ethiodide is heated at 140–150°c. for 2 hr. in pyridine with trimethylamine. In the formation of this dye the :CCH_3 group at the centre of the dye molecule must be provided by the decomposition of the quaternary salt. That this is the mechanism has been confirmed by use of the ^{14}C-labelled compound, 2-methylbenzothiazole ethiodide-2-^{14}C. C.O.C.

Quinone Series. XI— Reaction of 2:3-dichloro-1:4-naphthaquinone with dihydroxynaphthalenes
R. V. Acharya, B. D. Tilak, and M. R. Venkiteswaran
J. Sci. Ind. Res. (India), **16 B**, 554–557 (1957): *Chem. Abs.*, **52**, 15496 (25 Sept. 1958)

Condensation of 2:3-dichloro-1:4-naphthaquinone (1 mol.) with, e.g. 2:7-dihydroxynaphthalene (1 mol.) in pyridine gives 2′-hydroxy-1:2-benzobrazanquinone—



If 2 mol. of the 2:3-dichloro-1:4-naphthaquinone are used the alkali-insol. 1:2-1′:2′-dibrazanquinone is formed—



Earlier reports (Buu-Hoi, *Chem. Abs.*, **46**, 9545) stated that only the mono-condensation took place. Hydroxy- and methoxy-benzobrazanquinones and dibrazanquinones were prepared. These give orange to brown dyeings on cotton and substantivity tests showed that (1) dibrazanquinones had greater substantivity than benzobrazanquinones and (2) methoxy-benzobrazanquinones had greater substantivity than the parent brazanquinones. E.T.

Vinylanthracenes, and the Polymerisation of the 9-Isomer
E. D. Bergmann and D. Katz
J.C.S., 3216–3217 (Sept. 1958)

The 1-, 2-, and 9-vinylanthracenes have been prepared together with their polymers and copolymers in search of substances which contain fluorescent radicals in their mol., and to be of use for scintillation counters. It is found that the addition of a conjugated ethylenic bond in the 2- or 9-position of anthracene changes the fluorescence from blue to yellow, but that 1-vinylanthracene retains the blue fluorescence of anthracene. With 9-vinylanthracene, radical polymerisation (induced by benzoyl peroxide) is very slow, copolymerisation with styrene is quicker (the anthracene deriv. exhibiting the polymerisation of styrene), and cationic polymerisation with stannic chloride as catalyst is very fast; if small quantities of catalyst are used, a sol. polymer of pure blue fluorescence is obtained, but, with larger amounts, insol. products of slight yellow fluorescence are formed. The former appears to be a pure vinyl polymer, whereas the latter contains cross-links which involve the anthracene nuclei.
H.H.H.

Preparation and Application of *NN'*-Dihydro-1:2:2'-anthraquinone-azine, its Derivatives, and Anthraquinone Carbazoles
I. Back and A. Lorinc
Vegyipari Kitató Intézetek Közleményei **4**, 299–313 (1954): *Chem. Abs.*, **52**, 16313 (10 Oct. 1958)

Anthraquinone and 2-aminoanthraquinone do not couple in the alkaline fusion used in the preparation of indanthrones, e.g. C.I. 69800. The absorption spectrum of the fusion product indicated that it was indanthrene and this was confirmed by chromatography. Transformation of 2-aminoanthraquinone seems to take place in two phases, first the enolic variety forms, then a K salt which, at high temperature, yields a negative ion and each such ion reacts with 1 mole of 2-aminoanthraquinone, with liberation of H. The aminodianthraquinoline amine changes into indanthrene when heated in an inert solvent. Compounds prepared by this means are vat dyes: their application to cotton and regenerated cellulose is described.
C.O.C.

Advances in Acid Anthraquinone Dyes outside Russia
T. N. Kurdyumova
Khim. Nauka i Prom., **3**, 219–225 (1958): *Chem. Abs.*, **52**, 16745 (10 Oct. 1958)
Review, 53 references. C.O.C.

Advances in the Synthesis of Anthraquinone Vat Dyes
V. A. Titkov
Khim. Nauka i Prom., **3**, 174–190 (1958): *Chem. Abs.*, **52**, 16745 (10 Oct. 1958)
Review, 125 references. C.O.C.

Structure of Alizarin-3-sulphonate Chelates of Bivalent Metals
A. K. Mukherji and A. K. Dey
Research J. Hindi Science Academy, **1**, (1), 23–27 (1958)

In the chelates of alizarin-3-sulphonate with bivalent metal ions, the chelate ring may occur at two different alternative positions. The metal ion may be chelated either by (i) a pair of phenolic oxygens or (ii) a quinoid oxygen and an α-phenolic oxygen. Spectrophotometric evidence seems to support structure (i). C.J.W.H.

Dependence of the Properties of the Photoreduced Forms of Chlorophyll, Protochlorophyll, and Haematoporphyrin on Acid–Base Equilibrium Conditions
A. A. Krasnovskiĭ and E. V. Pakshina
Doklady Akad. Nauk S.S.S.R., **120**, 581–584 (21 May 1958)

The visible spectra of chlorophyll, protochlorophyll, and haematoporphyrin in the initial form, and the photoreduced form in ethanol–pyridine solution (using ascorbic acid as reducer) in both acid (a few drops of glac. acetic acid) and alkaline (piperidine, ammonia) conditions have been determined. These spectra are used to support the interpretation that, dependent upon the acid–base conditions there are different photo-reduced forms which possess not only different spectra but also different reactivity. G.J.K.

Spectrophotometric Study of the Leuco Esters of Vat Dyes
L. I. Belen'kiĭ, M. E. Kazanskaya, B. M. Yavorskiĭ, and V. D. Kamenetskiĭ
Zhur. Fiz. Khim., **31**, 1564–1571 (1957): *Chem. Abs.*, **52**, 16745 (10 Oct. 1958)

Stable water-soluble alkali salts of the leuco ester sulphonates of vat dyes were obtained by sulphonation of the leuco compounds with $ClSO_3H$ in pyridine and stabilisation at pH 10–11 with alkali salts, which act as buffers. The sulphonates were quantitatively converted to the hydrosols with thiourea sulphonate or with $Na_2S_2O_4 \cdot 2H_2O$ and both followed Beer's law, enabling their identification and quantitative colorimetric or spectrophotometric determination. The differences between the spectra of the sulphonates and the hydrosols seem to be caused by destruction of the conjugated double bonds in the hydrosols and appreciable lowering of the substantivity of the dyes. C.O.C.

Effects of the Position and Nature of the Substituent on the Fluorescence Spectra of Anthraquinone Derivatives in Frozen Solutions
D. N. Shigorin, N. A. Shcheglova, R. N. Nurmukametov, and N. S. Dokunikhin
Doklady Akad. Nauk S.S.S.R., **120**, 1242–1245 (21 June 1958)

The fluorescence spectra of anthraquinone and its β-hydroxy, β-chloro, β-methyl, and β-amino derivatives have been determined in solid solutions of hexane, heptane, and octane, and are compared with the previously determined spectra of 1-hydroxy-, 1-chloro-, and 1:5-, 1:8-, and 1:4-dihydroxy-anthraquinone, respectively (i.e. the α-derivatives). Unlike these α-derivatives, the β-substituted anthraquinones (except the β-hydroxy derivative) show intense bands of regular pattern, the separation between which approximates to 1664 cm^{-1}. Such separation is interpreted on the basis of the C=O vibrational frequency and the energy levels envolved are discussed in general terms. The anomaly shown by the β-hydroxy-anthraquinone is interpreted on the basis of external hydrogen bonding which occurs in neutral solvents, and at low concn. The remaining β-derivatives of anthraquinone fluoresce in the region 4600–6000 A. G.J.K.

Phthalocyanine Dyes for Textiles
L. G. Krolik
Khim. Nauka i Prom., **3**, 212–9 (1958): *Chem. Abs.*, **52**, 16745 (10 Oct. 1958)
Review, 19 references. C.O.C.

Copper Derivatives of Chlorophyll as Food Dyes
L. N. Pizzorno
Rev. farm. (Buenos Aires), **99**, 35–40 (1957): *Chem. Abs.* **52**, 16645 (10 Oct. 1958)

Use of Chlorophyll (C.I. Natural Green 3) as a food dye is discussed. It is especially used to restore or enhance the green colour of vegetables. The Cu chlorophyll compounds have strong and more stable colouring potency. The maximum admissible Cu content in food is 30 mg. Cu/Kg. as Cu Na chlorophyll complex in which the Cu is in organic linkage. C.O.C.

Intermediate Stages in the Formation of the Flavanols of *Prunus avium*
P. Comte, A. Ville, and G. Zwingelstein
Bull. Assocn. Française Chim. Ind. Cuir, **20**, 155–165 (Aug. 1958)

Previous work on the metabolism of the flavanols is reviewed at length. A study of the flavanols of *Prunus avium* has revealed that the precursors of the flavone deriv. are compounds related to cinnamic acid.
H.H.H.

Ommochromes, a Class of Natural Phenoxazon Dyes
A. Butenandt
Festschr. Arthur Stoll, 869–885 (1957)

PATENTS

Cyanides of Triarylmethane Dyes
L. Chalkley *USP* 2,839,543

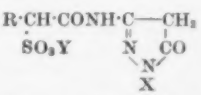
Colourless cyanides are readily obtained by heating a solution of a triarylmethane dye and an ionised cyanide in a sealed vessel under pressure. They are soluble in water to yield photosensitive solutions, irradiation with light or ultraviolet radiation of suitable wavelength reforming the dye. C.O.C.

Diazotisation of Amine Sulphates in Presence of Metal Chlorides
American Cyanamid Co. *USP* 2,827,449

The rate of diazotisation of primary aromatic amine sulphates in aq. H_2SO_4 can be increased by adding a soluble metal chloride, e.g. NaCl to the extent of 20–500% on the weight of amine. Thus benzidine sulphate, which can be readily obtained in a purer form than the hydrochloride, and is less readily absorbed by the skin, can be completely tetrazotised in 20 min. at 5–10°c. in presence of 5 times its weight of NaCl, but takes 360 min. in absence of NaCl.
E.S.

3-α-Sulpho Acylamine Pyrazolone Colour Formers whose Acyl Group contains a Long Aliphatic Chain
General Aniline *BP* 803,187

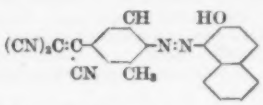
Compounds of formula—



(R = Alk of > 8 C; X = a radical of the benzene or naphthalene series; Y = H, alkali metal or amine) e.g. 3-(α-sulphostearoylamino)-1-(4′-bromophenyl)-5-pyrazolone are good non-diffusing colour formers for producing magenta images when used in colour photography and developing with a primary aromatic amino developer.
C.O.C.

Azo Dyes from C-Tricyanovinylarylamines
DuP *USP* 2,824,096

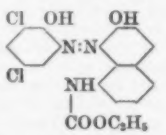
Arylamines having a C-tricyanovinyl substituent are diazotised and coupled with aromatic hydroxy or amino compounds to give azo dyes. Thus diazotised 4-tricyanovinyl-2:6-dimethylaniline is coupled with β-naphthol to give—



which dyes cellulose acetate red.
E.S.

Mordant Dyes
FH *BP* 803,287

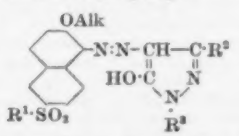
Azo dyes which are insoluble or sparingly soluble in a neutral or an acid bath and contain a metallisable group in *o,o′*-position to the diazo group, e.g. the dye—



are used in aqueous dispersion as metachrome or afterchrome dyes.
C.O.C.

Metallisable Monoazo Dyes of the Pyrazolone Series
General Aniline *BP* 803,404

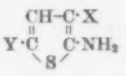
Monoazo dyes free of SO_3H groups—



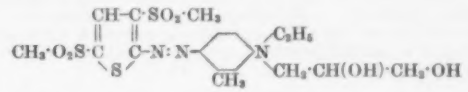
(R^1 = Alk, NH_2, NHAlk, $NAlk_2$, hydroxyalkylamino, dihydroxyalkylamino, morpholino, or piperidino; R^2 = Alk, carbalkoxy, or $CONH_2$; R^3 = H, Alk, hydroxyalkyl, cyanoalkyl or aryl of benzene series) are converted into Cr, Ni, or Cu complexes, in substance or on a substratum. Thus 2-ethoxy-1-naphthylamine-6-sulphonamide is diazotised and coupled with 3-methyl-1-*m*-sulphamylphenyl-5-pyrazolone, and the monoazo compound so formed heated with chromium formate in formamide at 165–170°c. for 5 hr. The product after mixing with a dispersing agent dyes wool pink from a neutral dispersion.
E.S.

Monoazo Disperse Dyes from 2-Aminothiophenes
Eastman Kodak Co. *USP* 2,827,450

Derivatives of 2-aminothiophene—



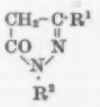
(X = NO_2 or SO_2Alk; Y = SO_2Alk or SO_2NHAlk; Alk has 1–4 C) are diazotised and coupled with suitable *N*-alkylanilines, tetrahydroquinolines, or benzomorpholines to give disperse dyes which give violets to blue-greens on cellulose acetate, nylon, sulphone polyester fibres, polyacrylonitrile fibres, and Dacron. Thus 2-acetamido-3:5-bischlorosulphonylthiophene is reduced with Na_2SO_3 to give the disulphinic acid which is refluxed with aq. sodium chloroacetate in presence of KI to give 2-acetamido-3:5-bismethylsulphonylthiophene. Hydrolysis of the acetyl group in boiling 4 N HCl then gives the amino compound, which is diazotised in nitrosylsulphuric acid and coupled with *N*-ethyl-*N*-β:γ-dihydroxypropyl-*m*-toluidine giving—



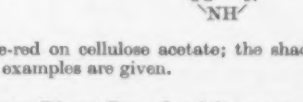
which dyes cellulose acetate bright violet.

Preparations of a number of the 2-aminothiophene compounds are described, and the shade on cellulose acetate of 175 monoazo combinations. Preparations of acrylonitrile graft polymers and sulphone polyester polymers are also given.
USP 2,827,451

The same diazotised 2-aminothiophenes are coupled with barbituric acid, and certain of its derivatives, or preferably with 5-pyrazolones—



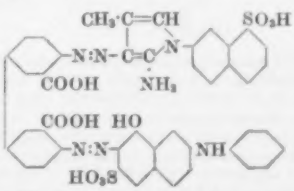
(R^1 = CH_3, COOH, $COOCH_3$, $COOC_2H_5$, phenyl, or CF_3; R^2 = H or phenyl) to give yellow to orange-red disperse dyes. The monoazo compound from diazotised 2-amino-5-methylsulphonyl-3-nitrothiophene and 3-trifluoromethyl-5-pyrazolone, viz.—



is an orange-red on cellulose acetate; the shades on this fibre of 104 examples are given.
E.S.

Brown Disazo Direct Dyes for Aftercoppering
FBy *BP* 802,097

Tetrazotised benzidine-3:3′-dicarboxylic acid (I) is coupled with 1 mol. of a 1-aryl-3-methyl-5-aminopyrazole and with 1 mol. of γ acid or its *N*-alkyl or *N*-aryl derivatives to give the title dyes. Thus I is coupled first with 1-(8′-sulpho-2′-naphthyl)-3-methyl-5-aminopyrazole and then with 1 mol. of *N*-phenyl-γ acid to give—



which dyes cellulose dark brown fast to light and washing when aftercoppered.
E.S.

Olive, Metal(Chromium)-complex Monoazo Dyes for Wool, Nylon, etc.
ICI *BP* 802,458

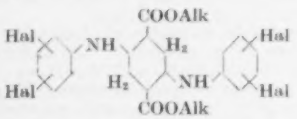
2-Amino-4(or 5)-nitrophenol, or preferably a mixture of the two isomers, is diazotised and coupled with 1-propionylamino-7-naphthol under alkaline conditions. The products are then converted into Cr complexes containing 1 atom of Cr to 2 mol. of monoazo compounds to give olive dyes for wool, nylon, etc., applicable from neutral baths. E.S.

Orange Metal-complex Monoazo Dyes for Nylon, etc.
General Aniline *USP* 2,829,139

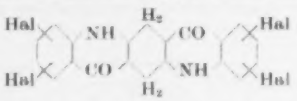
The metal (especially Cr, but also Co, Ni, and Cu) complexes of the monoazo compounds 2-aminophenol-4-sulphonamide→3-methyl-1-phenyl-5-pyrazolone, in which the phenyl radical of the pyrazolone may carry substituents such as Hal, Alk, or OAlk, dye nylon, wool, etc. orange from neutral baths. E.S.

Linear Tetrahalogenoquinacridones— Orange and Red Pigments
DuP *USP* 2,821,530

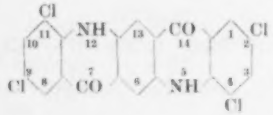
These products are prepared by condensing a dialkyl succinylsuccinate with excess of a dihalogenoaniline in presence of an acid catalyst under non-oxidising conditions to give a dialkyl tetrahalogeno-2:5-dianilino-3:6-dihydroterephthalate—



Heating in a high-boiling solvent in a non-oxidising atmosphere then gives the dihydroquinacridone—



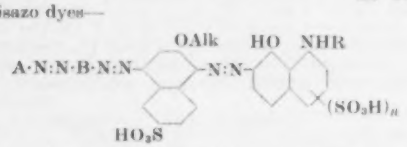
Mild oxidation removes an H atom from both the 6 and 13 positions to give the linear tetrahalogenoquinacridone. Thus 2:4-dichloroaniline, diethyl succinylsuccinate, aq. HCl and ethanol are stirred together under reflux in an atmosphere of N_2, and the product boiled in a mixture of diphenyl and diphenyl oxide to effect ring-closure. Oxidation with sodium *m*-nitrobenzenesulphonate then gives the orange pigment—



which is brought into fine particle size by sulphuric acid pasting followed by ball-milling in presence of salt and xylene. E.S.

Green Metal(Copper)-complex Trisazo Direct Dyes
FBy *BP* 803,322

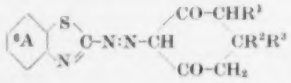
Trisazo dyes—



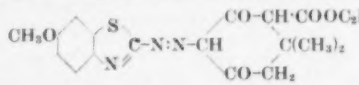
(A = aryl of benzene or naphthalene series; B = aryl of benzene series; R = H or acyl; n = 0, 1, or 2) some of which are described in *BP* 308,958 (J.S.D.C., **45**, 224 (1929)), are heated under acid conditions with Cu salts at > 100°c. to give green, dischargeable direct dyes. Thus the trisazo compound 2-naphthylamine-8-sulphonic acid → *m* - 5 - xylidine → 2 - ethoxy - 1 - naphthylamine - 6 - sulphonic acid→*N*-acetyl-H acid is stirred for 4 hr. at 115°c. in an autoclave with aq. $CuSO_4$ and sodium acetate. E.S.

Benzothiazole Azo Cyclohexanedione 1:3 Compounds — Metallisable Disperse Dyes
Eastman Kodak Co. *USP* 2,822,359

Diazotised 2-aminobenzothiazoles are coupled with cyclohexanedione-1:3 compounds to give monoazo disperse dyes—



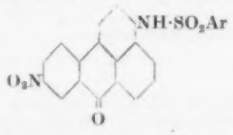
(A may contain substituents such as Alk, OAlk, SO_2Alk, SO_2NHAlk, particularly in the 6 position; R^1 = H, OCH_3, OC_2H_5, CN, $COOCH_3$, or $COOC_2H_5$; R^2 and R^3 = H, CH_3, or C_2H_5), which may be metallised (*a*) in substance to give dyes for wool, nylon, etc. or (*b*) on the fibre, e.g. cellulose acetate to give dyeings of high wet fastness. The preferred aftertreatment on the fibre is a steaming with cobalt (or preferably nickel) thiocyanate, and the range of shades so produced includes orange, red, violet, brown, green, grey, and black. Thus 2-amino-6-methoxybenzothiazole is diazotised with nitrosyl sulphuric acid in presence of acetic-propionic acid mixture and coupled with 4-carboethoxy-5:5-dimethylcyclohexanedione-1:3 to give—



which dyes cellulose acetate yellow, converted to red of improved fastness to light and washing by padding with 2% aq. $Ni(SCN)_2$ followed by drying and steaming at 5 lb. per sq.in. pressure for 20 min. E.S.

Aminobenzanthrones and Derived Direct Azo and Azoic Dyes
American Cyanamid Co. *USP* 2,821,533

Bromination of benzanthrone followed by nitration gives the 3-bromo-9-nitro compound. Condensation in a high-boiling solvent in presence of Cu and an acid-binder with an arylsulphonamide (e.g. *p*-toluenesulphonamide) then gives a 9-nitrobenzanthrone-3-arylsulphonamide—



Reduction of the NO_2 with Na_2S then gives the amino compound (I), and subsequent hydrolysis gives 3:9-diaminobenzanthrone (II), which may be tetrazotised and coupled with suitable coupling components to give direct dyes. H acid for instance gives a greenish blue. Both I and II may be used as diazotisable bases to produce azoic dyeings on cellulose impregnated with arylides of 3:2-hydroxynaphthoic acid (III). Thus I with the *o*-toluidide of III gives a blue-red, and II with the *α*-naphthylamide of III gives a blue. E.S.

Purification of Cyanides of Triarylmethane Dyes
L. Chalkley *USP* 2,829,148

Di- and tri-primary amino triarylmethane dyes are much more soluble in triethyl phosphate then in ethyl alcohol and may be precipitated in pure crystalline form from solution in triethyl phosphate. Moreover, triethyl phosphate converts the dye carbinol which often has very similar properties to the corresponding dye cyanide, to the more easily separated dye. As the dye cyanides are equally as soluble in triethyl phosphate at room temperature as at 100°c. recrystallisation by cooling concentrated hot solutions is impossible, however they are precipitated in substantially pure state by diluting the solution with water. C.O.C.

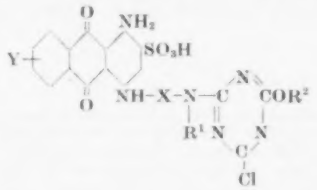
New Fuchsine Cyanide
L. Chalkley *USP* 2,829,149

New Fuchsine (C.I. Basic Violet 2) when treated in aqueous solution with NaCN yields the colourless, hydrophobic 4:4′:4″-triamino-3:3′:3″-trimethyltriphenyl acetonitrile. This is used in combination with suitable photoactivators to prepare photographic emulsions which yield bluer and so "darker" coloured images than do Fuchsine (C.I. Basic Violet 14) and Parafuchsine (C.I. Basic Red 9) hitherto used. C.O.C.

Anthraquinone Acid Dyes

ICI *BP* 803,473

Reddish-blue to greenish-blue acid dyes having high affinity for wool from neutral or faintly acid baths and of high fastness to light and washing are of formula—



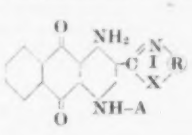
(R^1 = Alk, hydroxyalk or arylalk; R^2 = Alk, *cyclo*alk, aralkyl or aryl; Y = SO_3H or H; X = Subst. or unsubst. bridging group, provided that the dye mol. contains ≥ 2 SO_3H groups). The anthraquinone starting material is made, e.g. by reacting 1-amino-4-bromoanthraquinone-2-sulphonic acid with NH_2-X-NHR^1 (*p*-methylaminoaniline, *m*-β-hydroxyethylaminoaniline, 4-methylamino-3-sulphoaniline etc.). The other starting material is derived from cyanuric chloride reacted with a hydroxy-compound, e.g. methanol, ethanol, a propanol or butanol, benzyl alcohol, phenol etc. An acid-binding agent may be used in the subsequent condensation. Thus, a suspension formed by slowly adding 2:4-dichloro-6-methoxy-*s*-triazine (4) in acetone (20) to water (80) and crushed ice (80) is warmed to 30°c. and a solution of 1-amino-4-(4′-methylaminoanilino)-anthraquinone-2:3′-disulphonic acid (10·94) in water (250) is added over 1½ hr. at 29–30°c. After a further 1 hr. at 29–30°c., the mixture is cooled to 18°c. and neutralised with 10% aq. Na_2CO_3. NaCl to give 240 g/l is added, the mixture is warmed to 33°c., held at 33°c. for 15 min., cooled to 20°c. and filtered. Washing with 20% brine and drying at room temperature follow.

E.T.

Anthraquinone Vat Dyes

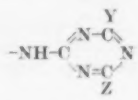
Ciba *BP* 802,681

Violet, blue-violet, blue and grey vat dyes giving dyeings and prints on vegetable fibres of great colour strength and very good fastness properties are of formula—

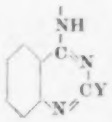


(A)

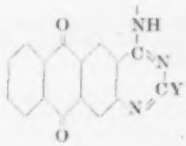
(X = O, NH, NAlk, NAr, S; R = a cyclic residue in which the hetero-ring I contains 2–3 C which also belong to the non-vattable ring R; the NH–A group = among others, an acylamino group derived from a monocarboxylic acid). The ring system R may be aromatic or heterocyclic and may have subst. groups as, e.g. F, Cl, Br, low mol. wt. Alk or alkoxy, alkyl- or phenyl-sulphones. It may be attached directly, *or* via $-SO_2-$ or $-CONH-$, to further ring systems which may be vattable. The NH–A group can be an acylamino derived from a benzene, naphthalene or anthraquinone carboxylic acid; in addition, it may be—



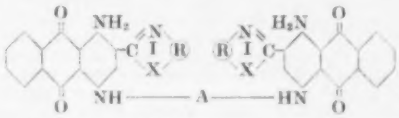
(derived from reaction of NH_2 groups with halogen triazines) or



or, a phthaloyl quinazoline residue—

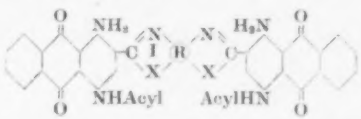


(Y, Z = e.g. Hal, OH, NH_2, aryl, anthraquinonyl or NH aryl). Dyes in which two anthraquinone nuclei are linked via the two acylamino groups in the 4-positions are also claimed; thus—



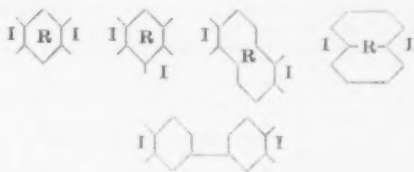
(B)

Further dyes in which two anthraquinone nuclei are linked via the hetero-rings are—



(C)

In such dyes the residue R may be—

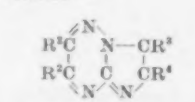


A starting material for manufacture is 1-amino-4-nitroanthraquinone-2-carboxylic acid chloride which is condensed with an amine whose NH_2 group is attached to a non-vattable ring system and which has an OH, primary or secondary amino, Hal, NO_2, or SH group in an *o*- or *peri*-position. Ring closure follows to give the heterocyclic ring I and the 4-NO_2 group is then reduced to NH_2. Dyes of formula (A) are then made by reaction with, e.g. a monocarboxylic acid chloride; those of formula (B) with, e.g. a dicarboxylic acid dichloride. In making the intermediate, further reaction can be carried out on the ring system condensed with the hetero-ring. Intermediates for dyes of formula (C) may be made in a manner similar to that mentioned above in which 2 mol. 1-amino-4-nitroanthraquinone-2-carboxylic acid chloride are condensed with 1 mol. of a compound capable of forming two hetero rings; e.g. 1:4-diamino-2:5-di-halogenobenzene, 1:5-diamino-4:8-dioxynaphthalenes, etc. Alternatively, 1-aminoanthraquinone-2-carboxylic acid chloride may be used as the starting material. In this case, condensation and ring closure to form the hetero-ring are followed by nitration or halogenation in the 4-position. Reduction or replacement then gives the 4-amino derivatives. E.T.

Fluorescent Tetraazoindenes

Industria Chimica Profarmaco *USP* 2,837,520

Compounds of formula—



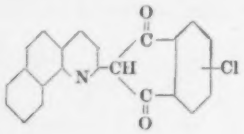
(R^1, R^2, R^3, and R^4 = H, Alk or subst. or unsubst. Ar) have intense fluorescence. They are very resistant to heat, e.g. they can be used in polystyrene resins, chemically inert and of excellent fastness to water, weathering, and light. They are obtained by treating suitable 3-amino-1:2:4-triazines with an appropriate α-halogeno carbonyl compound. Thus 5-phenyl-3-amino(1:2:4)triazine is refluxed with phenacyl bromide in ethanol. The product is the yellow 5:5′-diphenyl(2·3:2′·3′)imidazole(1:2:4)triazine.

C.O.C.

Yellow Quinophthalone Dyes from α-Naphthoquinaldine and Chlorinated Phthalic Anhydride

American Cyanamid Co. *USP* 2,828,311

Quinophthalone dyes of good strength and fastness to light are obtained from α-naphthylamine if the intermediate α-naphthoquinaldine is condensed with a chlorinated phthalic anhydride. Thus α-naphthylamine (300 parts), HCl 20° Bé (660), nitrobenzene (35), hydrated ferrous sulphate (15) and hydrated $CuSO_4$ are brought to 100–103°c. and then a mixture of crotonaldehyde (250) and nitrobenzene (79) slowly added. The mixture is refluxed until reaction ceases, neutralised to pH 7–9 with NaOH and Na_2CO_3 and the low boiling material (quinaldine, aniline, nitrobenzene, etc.) removed by steam stripping. The residue is washed free of salt by decantation and distilled at 3–6 mm. absolute pressure. The product (62) is heated with a mixture of 3- and 4-monochlorophthalic anhydride (59·5) at 208–212°c. to yield the yellow dye—

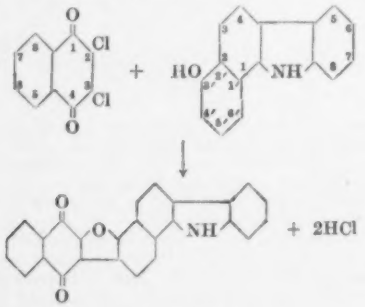


C.O.C.

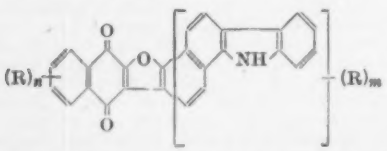
Brown Vat Dyes

General Aniline *BP* 803,249

Reddish-brown to violet-brown dyes, of good fastness to washing, chlorine, and light and which give excellent prints, are produced by the following reaction—



The formula of dyes claimed is—



(R = NO_2, NH_2, Hal, CH_3 or C_2H_5; n = 0–1; m = 0–3). The reaction takes place under reflux in an organic solvent in which the reaction product will not dissolve at 70–150°c. in the presence of an acid-binding agent. Thus, 3′-hydroxy-(benzo-1′:2′:1:2-carbazole) (4·7) and 2:3-dichloro-1:4-naphthoquinone are refluxed 3 hr. in pyridine (50) The melt is filtered at room-temperature and washed with pyridine, alcohol, and acetone before drying. The product dyes cotton a strong reddish-brown from an alk. $Na_2S_2O_4$ vat. E.T.

Non-flocculating Non-crystallising Phthalocyanine Pigments

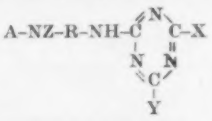
General Aniline *BP* 804,031

Incorporation of small amounts of alkaline earth metal salts of sulphonated zinc phthalocyanine renders copper phthalocyanine blue pigments (C.I. Pigment Blue 15) non-flocculating and non-crystallising. Thus copper phthalocyanine (100 parts) sulphonated zinc phthalocyanine (1·5) presscakes were slurried with water (1000) and $BaCl_2$ (1·5) in water (10) added. Filtering and washing yielded a presscake containing a pigment which had no tendency to flocculate or crystallise. C.O.C.

Anthraquinone Disperse Dyes

ICI *BP* 802,935

Red, violet or blue dyes of excellent wet fastness and especially suitable for dyeing nylon are of formula—

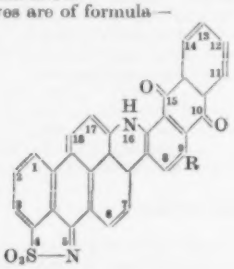


(A = Subst. or unsubst. anthraquinone nucleus; Z = H, Alk or subst. Alk; R = alkylene or phenylene; X = Hal; Y = Hal, NH_2 or organic radical containing a N, O or S atom through which it is linked to the triazine ring). They are prepared by interacting an aminoanthraquinone free from SO_3H groups wth a halogeno-1:3:5-triazine in an organic solvent, e.g. 1:4-dioxane, acetone, chlorophenol, with or without water and an acid-binding agent. Thus, 1-(4′-aminoanilino)-anthraquinone (12·56) in 1:4-dioxane (200) is added slowly to cyanuric chloride (8·12) in acetone (100) at 5°c. $NaHCO_3$ (3·2) in water (60) is added and the mixture is stirred at 3–5°c. for 30 min. Addition of water (200), filtration, water-washing and then acetone-washing follow. The product is dried at 60°c. and contains 15·3% Cl. It dyes nylon from an aq. dispersion a reddish-purple of good fastness. E.T.

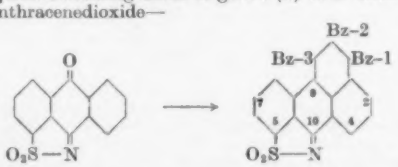
Acridine Vat Dyes

American Cyanamid Co. *USP* 2,820,790

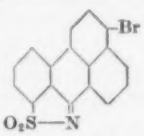
Green vat dyes of formula—



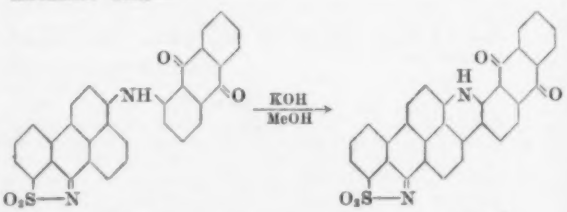
(R = H, OCH_3 or NH_2). Preparation is as follows—1 (8) 9 (N) *iso*thiazoloanthraquinone dioxide (Ullmann and Kertesz, *Ber.*, **52**, 545 (1919)) is treated with glycerine, H_2SO_4 and a reducing metal to give 5 (8) 10 N *iso*thiazolobenzanthracenedioxide—



Halogenation (usually bromination) in acetic acid gives—



which is condensed with a subst. or unsubst. 1-aminoanthraquinone to give an anthrimide. This product then undergoes ring-closure when refluxed with KOH and methanol. Thus—

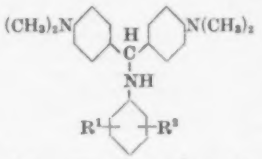


Reaction details are given. E.T.

Leucauramine Derivatives

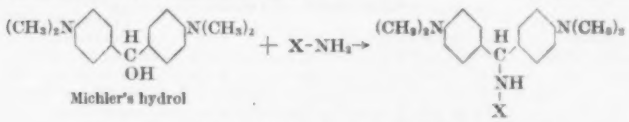
National Cash Register Co. *BP* 804,087

Light- and atmospherically-stable, colourless, crystalline leucauramine derivatives suitable for printing blue-green or dark blue on paper containing acidic inorganic compounds (e.g. atapulgite, kaolin, bentonite, $Al_2(SO_4)_3$ etc.) are of formula—



(R^1 = CH_3; R^2 = Br or Cl)

These alkyl and Hal derivatives are more suitable for transfer coatings in manifold record systems than the unhalogenated *N*-phenylleucauramine because they are less volatile and have greater oil-solubility. They are made, e.g. by refluxing 4 hr. on a steam-bath 2-methyl-5-chloroaniline (70·8), Michler's hydrol (135) and ethyl alcohol (500). The crystals separating on cooling are filtered, dissolved in benzene (1·5 l) and treated with activated C and fuller's earth. After filtering, the filtrate is concentrated to 200 ml., cooled, and the pure white product is separated by adding petroleum ether. The general reaction is illustrated thus—



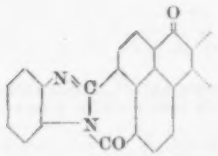
(X = Alk and Hal subst. phenyl where Hal = Br or Cl).

E.T.

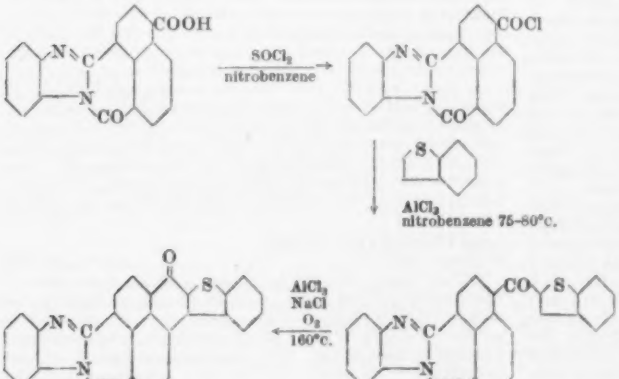
Benzimidazo-Benz*iso*quinoline Vat Dyes

General Aniline *USP* 2,820,036

Reddish-brown to deep chocolate brown vat dyes of good fastness to light, washing and chlorine on cotton are of formula—



(the two dotted lines can form ring systems with thionaphthene, carbazole, biphenylene sulphide, fluoranthene and other carbo- and hetero-cyclic compounds capable of giving the Friedel-Crafts reaction). Preparation is as follows, e.g.—

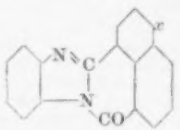


Nitrobenzene (45), 1:8-naphthoylene-benzimidazole-4-carboxylic acid chloride (*USP* 2,820,037—see next abstract), (3·4), anhydr. $AlCl_3$ (12·3) and thionaphthene (1·4) are stirred 3 hr. at 75–80°c. After pouring into water and adding conc. HCl (5), the nitrobenzene is removed by steam-distillation and the resulting ketone separated by filtration. Heating at 70°c. for 30 min. with water (150) and 28% ammonia (30) followed by filtration removes any unchanged 1:8-naphthoylene-benzimidazole-4-carboxylic acid (from the acid chloride). For the final cyclisation, anhydr. $AlCl_3$ (54) and NaCl (12) are heated to 160°c., the ketone (3·5) is added and stirring at 160°c. for 5 hr. in a fast stream of O_2 follows. Drowning into water (250) and conc. HCl (13), boiling for 10 min., filtration, washing and drying give the vat dye (3·4). E.T.

Benzimidazobenz*iso*quinoline Intermediates

General Aniline *USP* 2,820,037

Vat dye intermediates are 4-substituted 1:8-naphthoylene benzimidazoles of formula—



(x = CN, COOH or COCl). They are used for producing the vat dyes of *USP* 2,820,036 (above). When x = CN; preparation is by treating, e.g. 4-bromo-1:8-naphthoylene-benzimidazole with cuprous cyanide in pyridine at 130–170°c. in an autoclave. (The starting material is made by reaction of 4-bromonaphthalic anhydride and *o*-phenylene diamine in glacial acetic acid.) When x = COOH; the 4-cyano compound is hydrolysed to give the 4-COOH group using equal parts of conc. H_2SO_4 glacial acetic acid and water at 100–140°c. When x = COCl; the 4-COOH compound is treated with thionyl- or phosphorus chloride. Details are given for these three reactions. E.T.

Phthalocyanine Lakes

General Aniline *USP* 2,838,415

Forming the alkaline earth metal resinate lake of a water-insoluble phthalocyanine colorant in presence of an ammonium salt of a strong acid yields a product which is readily dispersed in ink and paint vehicles, plastics etc., and has rheological properties making it suitable for use in lithographic varnishes. Thus Cu hexadecachlorophthalocyanine (C.I. 74260) acid pasted presscake was made into an aqueous slurry, brought to pH 7·5–8·0 with ammonium, NH_4Cl added and the mixture brought to 95°c. A solution of wood rosin in 1% aqueous NaOH was added and the whole heated at 95–98°c. for 30 min. Then aqueous $BaCl_2$ was added, the slurry boiled for 30 min. and cooled to 65°c. by adding cold water. The product obtained on filtration, washing and drying was much superior in texture to that obtained in absence of NH_4Cl. C.O.C.

1:2-Propanediol Solution of Annatto (C.I. Natural Orange 4) for Colouring Foods

R. B. Kocher *USP* 2,831,775

The solution obtained by extracting annatto seed with 1:2-propanediol in presence of an alkaline material which is at least partly soluble in the 1:2-propanediol, e.g. KOH, yields a product of outstanding purity of colour which can be used directly as a food dye. Such solutions, even when kept at 0°F. or below, do not freeze nor do they show any tendency for sedimentation to occur. C.O.C.

Alumina-(and/or Ferric Oxide)-Silica Pigment

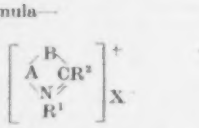
Columbia-Southern Corpn. *USP* 2,837,495

Pigments of composition $M_2O_3(SiO_2)_x$ (x = 6·5–500; M = Al and/or Fe) are non-toxic to rubber. They may be prepared e.g. by treating a finely-divided calcium-aluminium sulphate or calcium–iron sulphate of particle size < 0·05 μ. with hydrochloric acid. C.O.C.

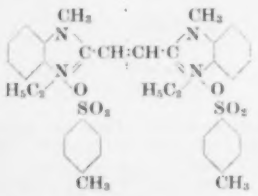
Fluorescent Brightening Agents

Ciba *BP* 803,361

Compounds of formula—



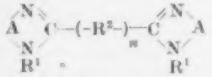
(A = a subst. or unsubst. aromatic nucleus in which two vicinal C atoms are directly attached to B and to $-\overset{|}{N}R^1$; B = S or $R^2N<$ (R^2 = H or an organic substituent); R^1 = an organic substituent; R^2 = an organic substituent containing > 2 conjugated double bonds which are also conjugated with the >C=N bond of the hetero ring; X = acid residue; neither A, B, R^1, R^2 nor R^3 contains groups giving rise to colour), are used either as ultraviolet radiation absorbers or as fluorescent brightening agents. Thus the compound—



is a fluorescent brightening agent for use on nylon.

BP 803,362

Compounds of formula—



(A = aromatic nucleus, subst. or unsubst., having two vicinal C atoms linked to the two imidazole N atoms; R^1 = H, Alk, Ar or aralkyl and may be substituted; R^2 = a divalent group containing at least one double bond which forms with the >C=N double bonds of the imidazole rings an uninterrupted series of conjugated double bonds; n = 0 or 1) are treated with compounds which quaternate the imidazole N atoms to yield fluorescent brightening agents. Thus $\alpha\beta$-di-[*N*-methylbenzimidazyl-(2)]-ethylene is stirred for 8 hr. at 145–150°c. with *p*-toluene sulphonic acid ethylester to yield the compound cited in the preceding abstract. C.O.C.

Metal-free Phthalocyanines

DuP *USP* 2,820,796

Earlier patents for producing metal-free phthalocyanines are reviewed and it is stated that methods for removing the metal from metal-containing phthalocyanines are expensive and often incomplete. Thus the economically favourable phthalic anhydride–urea process gives Cu, Ni, and Co derivatives which are practically impossible to de-metallise whilst the much less stable alkali and alkaline–earth metal derivatives from this process show poor yields. The present patent claims that metal-free phthalocyanine (92% purity) in 61·2% yield can be obtained. Phthalic anhydride (166·6 g.), urea (333·2 g.), NH_4 molybdate (1 g.), and trichlorobenzene (900 ml.) are heated during 2 hr. to 155°c. and held at 155–60°c. for 1 hr. 100 mesh Sb powder (51·5 g.) and crystalline NH_4Cl (67·7 g.) are added. Heating at 200°c. for 5 hr., cooling, filtration and washing with (*a*) trichlorobenzene (1000 ml.) and (*b*) acetone (1000 ml.) follow. The filter-cake, water (1000) and NaOH (100) are heated to remove residual solvents by steam-distillation and the metal-free phthalocyanine is decanted from the Sb powder, filtered and washed alkali-free. Purification by heating with conc. HCl (500 ml.) for 30 min., filtration, washing with conc. HCl and finally with water give the metal-free phthalocyanine (96·2 g.) which, after drying, is acid-pasted to give the bright greenish-blue pigment. Polychloro metal-free phthalocyanine is similarly made from tetrachlorophthalic anhydride. E.T.

Salts of Basic Dyes for use in Coloured Writing Inks and in Colouring Plastics

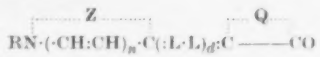
FBy *BP* 803,525

Inks containing salts of (*a*) azo, anthraquinone, phthalocyanine and oxazine dyes containing at least one sulphonamide, carbonamide or aminoalkyl group and substituted at one or more N atoms of the amide or aminoalkyl groups by an aliphatic radical containing a tertiary N atom, with (*b*) inorganic or carboxylic acids, organic sulphonic acids or esters of organic di- and poly-basic acids containing one free COOH group, produce writing of exceptional fastness to light and other fading agencies. Thus an ink prepared by joining a thin aqueous paste of the dye base prepared from copper phthalocyanine di- and tri-sulphochlorides and 1-amino-3-dimethylaminopropane by the method of *BP* 784,843 (J.S.D.C., **74**, 99 (1958)), is screened and then phthalic acid mono-octyl ester slowly added, stirred for 2 hr., filtered, and dried at room temperature for 12 hr. and then at 100°c. for 6 hr. yields a product which is soluble in thiodiglycol and glycolmonoethyl ether but insoluble in ordinary solvents, e.g. alcohol, benzene, and esters. By suitable choice of the acid component of the basic dye salt products are obtained which are suitable for colouring plastics. C.O.C.

*mero*Cyanine Dyes

Eastman Kodak Co. *USP* 2,839,403–4

Dyes of formula—



(R = Alk; d = 0, 1 or 2; n = 0 or 1; L = methin; Q = atoms to complete a nucleus of the 2-thiohydantoin series; Z = atoms to complete a 5- or 6-membered ring), e.g. the red 3-ethyl-5-(3-ethylbenzoxazolin-2-ylidene-ethylidene)-1-(2-pyridyl)-2-thiohydantoin, have photosensitising properties. C.O.C.

Modified Bixin as Food Dye

Chas. Pfizer & Co. *USP* 2,830,908

An ester of bixin (C.I. 75120) or a nor-bixin di-ester is heated in liquid medium preferably an ester of a higher fatty acid at 95–125°c. The type of ester, the temperature and time of heating are all interrelated in their effect upon the development of the properties of the product. Prolonged heating lessens the colour value without increasing solubility in oil. The liquid medium may be either an oil or a fat which is normally solid. The liquid or solid products obtained are used directly as food dyes. C.O.C.

Recovering Chlorophyll (C.I. Natural Green 1) from *Agave lechugvilla* and Similar Plants

G. J. Nord *USP* 2,827,454

The juice obtained in passing the leaves through a roller press mill and a decorticator of special design is adjusted to pH 4·2–4·8 and transferred to a holding tank through a jacketed tubular heater where in its passage it is instantaneously heated to 40–95°c. This results in formation of a precipitate of grey, chalky consistency but without any coagulation or agglomeration of the chlorophyll and related pigments. After standing in the holding tank for a short time or until clotting occurs the liquid is separated from the insoluble matter. The clarified juice is discharged into a vessel surrounded by a jacket through which cold water or a refrigerant is passed so as to cool the juice rapidly to 30°c. 0·5% of borax or other agent which will coagulate and/or precipitate chlorophyll is then added to produce a flocculent precipitate containing the chlorophyll and related plant pigments. This precipitate is separated to yield a solid containing about 1% of chlorophyll. This is then treated by known methods, e.g. sequential extraction by solvents, to produce a chlorophyll fraction of high strength. C.O.C.

Lead Dioxide (C.I. 77580)

National Lead Co. *USP* 2,837,405

Molten lead is treated with caustic alkali and oxidised. The resulting fused mass of alkali plumbate dissolved in caustic alkali is slurried with a small quantity of water to produce a slurry of solid alkali plumbate in concentrated aqueous caustic alkali. The plumbate is filtered off and hydrolysed with water and the PbO_2 separated from the aqueous caustic alkali produced. C.O.C.

Calcium Carbonate (C.I. Pigment White 18)
Georgia Marble Co. *USP* 2,830,914

A filler and extender pigment which is readily dispersed in a water-thinned vehicle and renders possible faster drying of films containing it, is produced by crushing white marble to pieces of 2 in. diameter. These are fed in Harding's conical mills, or similar reducing apparatus, and reduced to the desired particle size by rubbing against one another in presence of water. The resulting slurry is classified as to particle size in a centrifuge, concentrated in a Dorr thickener and dried. Just before drying 0·01–1·0% by weight of a polymeric material containing carboxyl groups, e.g. Tamol 731 (Rohm & Haas Co.) on the dry weight of the pigment is added to the slurry. Finally the dried material is passed through a micro pulveriser. C.O.C.

Channel Carbon Black (C.I. Pigment Black 8 and 7)
Godfrey L. Cabot *USP* 2,830,879

Improved colour and workability in paint, varnishes, ink, etc. is obtained by allowing air or air mixed with an inert or combustible gas to provide an oxidising, neutral or reducing atmosphere as desired, to flow against the Carbon Black deposited in the channels in zones placed at intervals along them and between groups of gas jets making the pigment. These zones are so placed in respect to the pigment make zones as to always lie in the direction of channel down travel from the make zone so that the pigment deposited on the channel will be carried from make to treat zone. The treated pigment is scraped from the channel before it can be exposed to make gas jets. C.O.C.

Recovering and Pelleting Carbon Black (C.I. Pigment Black 6 and 7)
Phillips Petroleum Co. *USP* 2,835,562

The pigment slurry recovered from a quench zone in a Carbon Black producing plant is passed through a grit separator and then into a pelleting mill where the dry pigment from the plant is being pelleted in a semi-wet or wet pelleting process. By this means all the pigment knocked down in the quenching of the smoke from the reactors is recovered and incorporated into the pellets without having to return the slurry to one of the quench zones. C.O.C.

Red Lead (C.I. Pigment Red 105)
DuP *USP* 2,836,483

Red lead can be rendered free-flowing by pasting it with a chloroprene polymer in a volatile organic solvent, drying until a friable material is obtained, forcing through a screen to granulate it and then evaporating off the remainder of the solvent. C.O.C.

Silica Dioxide (C.I. Pigment White 27)
New Jersey Zinc Co. *BP* 803,560

Very finely-divided silica of increased surface area (as measured by N adsorption procedure) is produced by burning silicon sulphide vapour in excess of air. The product shows little tendency to form accretions in the combustion chamber. C.O.C.

Silica Gel Flatting Agent
W. R. Grace & Co. *USP* 2,838,413

Silica gel is impregnated with an inert, high m.p. wax which is insoluble in the solvent in which it is used. When added to varnish the treated gel remains in suspension for a long period. C.O.C.

Metal Flakes
American-Marietta Co. *USP* 2,839,378

Mirror-plate flakes 3–25 millionths of an inch thick and transparent because of their thinness are produced by depositing a high light-reflecting metal as a film $\geq$ 25 millionths of an inch thick on a coated base. The coating on base is such that it can be softened or dissolved by a liquid which does not affect the metal. The film is released from the base by treatment with such a liquid and is then agitated in the liquid to break it up into flakes of the desired size. Thus an aluminium panel was coated on both sides with a maleic anhydride modified ester from resin solution and air dried. It was then coated with aluminium in a vacuum plating chamber. The coated plate was then soaked in xylene to soften the resin, the aluminium coating scraped off and then thoroughly agitated in xylol to convert it into flakes. C.O.C.

Alumina-coated Pigments
DuP *BP* 803,454

The pigment is mixed with an aluminium alcoholate or aluminium phenate and dry ground in presence of superheated steam or water vapour. The process is particularly applicable to TiO_2 (C.I. Pigment White 6) to improve its colour retention properties. C.O.C.

Optical Properties of Pigments in the Near Infrared (V p. 72)

V—PAINTS; ENAMELS; INKS

Pigment Dispersion
W. Carr and J. H. Astbury
J. Oil & Col. Chem. Assocn., **41**, 629–643 (Sept. 1958)

The high water content of aqueous pigment pastes makes it difficult to attain deep shades without impairing the film-forming properties and viscosity of the binder system; no satisfactory solution to this has yet been found. Anionic dispersing agents are the most efficient but pastes containing them cannot be used with cationic materials such as proteins in alkaline soln. Non-ionic dispersants overcome this difficulty, though they are of much lower efficiency. The breakdown of emulsions containing pigment pastes with non-ionic dispersants is attributed to the adsorption of non-ionic emulsifying agents by the colouring matter. Difficulties such as flotation, streaking, and brushing-up arise from flocculation or aggregation of the pigment. Arylamide yellows may, by virtue of their hydrophobic nature, be flushed into the non-aqueous phase and, though they retain their good dispersion, they become masked by other constituents which remain in the aqueous (and uppermost in a drying film) phase; they thus appear to lose colour-value. Flushing may be retarded by incorporation of a powerful wetting agent, or the use of yellows fixed on inert bases such as blanc fixe. It may be prevented in oil-bound distempers but cannot be so in P.V.A. (polyvinyl alcohol) emulsions. The degree of flushing varies considerably with the emulsion used, and with the type of yellow pigment paste, but it varies only very slightly with the type of thickening agent used, and is independent of the rate of addition of the yellow. Phthalocyanine blues (I) lose colour-value through aggregation and there is no evidence of flushing. Thickeners based on methylcellulose have a greater tendency to cause flocculation of a phthalocyanine blue than those based on etherified starches, and the more concentrated the pigment paste, the more it is liable to flocculate when added to P.V.A. This may be due to the stripping of the protective sheaths of water molecules from the pigment particles by the thickening agent; there is also evidence that water dispersions of I are subject to flocculation through dilution shock.

The principles governing the dispersion of pigments in non-aqueous media are outlined. Degree of dispersion can only be measured indirectly and all existing methods are open to criticism. Ease of dispersion may be governed by liquid–solid interfacial tension or by the magnitude of the van der Waals forces within the pigment; the relative importance of these factors is impossible to assess. Flotation is probably due to wide differences in degree of dispersion amongst individual pigments in a paint, arising from differences in the power of the medium to wet them. Improvement in the wetting power of the medium reduces liability to flotation, but many of the worst-offending pigments are also susceptible to flocculation and do not respond well to added surfactants. Carbon black and phthalocyanine blues are susceptible to dilution shock in non-aqueous media. A recent development is that of pigment powders that can be incorporated without grinding or milling; these are produced by dispersing the colour in a solvent-soluble, thermoplastic polymer on a heated triple-roll mill, and pulverising the cooled mass. The act of dissolving the polymer in the paint vehicle releases the pigment in a ready-dispersed state. J.W.D.

Zinc Oxide in Ships' Paints—Three-year Marine Exposure Tests
A. Pass and E. A. Fishwick
J. Oil & Col. Chem. Assocn., **41**, 653–675 (Sept. 1958)

Optical Properties of Pigments in the Near Infrared
D. Taylor
J. Oil & Col. Chem. Assocn., **41**, 707–729 (Oct. 1958)
The optical properties of pigments in the near infrared are important in the formulation of surface finishes for thermal insulation and camouflage, and for finishes that are to be cured by radiant heating. Methods of measurement are discussed, and optical data are given for 56 pigments, obtained from spectrophotometric measurements on paint films within the 700–900 mμ. waveband. This information is applied to the formulation of camouflage shades as illustrated in *B.S.* 987C.
J.W.D.

Areas of Difference and Similarity in the Pigmentation of Conventional and Aqueous Systems
L. R. Sherman
Off. Dig. Fed. Paint Varn. Prod. Cl., **30**, 965–973 (Sept. 1958) (Part I)
Problems in pigmentation that arise from the use of aqueous vehicles are examined in terms of knowledge of conventional paint pigmentation. Fundamental differences, such as vehicle structure, film formation mechanisms, effect of phase differences on colour migration, and similarities, such as processing equipment, pigment–binder ratios, and important film properties are discussed and compared. Desirable and potential improvements in aqueous paint pigmentation are discussed. J.W.D.

Dispersion and Tinting Strength of Iron Oxides
M. Kronstein and M. Treade
Paint Varnish Production, **48**, (2), 50–1, 82–3, (1958): *Chem. Abs.*, **52**, 16756 (10 Oct. 1958)
Study of the effects of soyabean lecithin on the dispersion of iron oxide pigments. Using a selected group of iron oxide pigments and a combination of 2 lb. of pigment to 1 gallon of a selected phenolic varnish revealed that when 3–8% of lecithin (on wt. of pigment) is added to the pigment–vehicle mixture before grinding, desirable effects on "change in colour" and dispersion are obtained. Lecithin additives also increase the tinting strength of iron oxides used together with rutile TiO_2. Dispersions were made on a Hoover–Muller apparatus using 150 lb. weight for 50 revolutions, then a "pick-up" and 50 more revolutions at the same pressure. Dispersions were applied to a standard White Morest chart at 1·5-mil. wet films and dried at room temperature. Tristimulus values were determined with a Photovolt Photoelectric Reflection Meter model 610 and "change in colour" calculated in accordance with Method 623·1 of Federal Specification TT–P–141b. C.O.C.

Drying and Driers
L. H. Allan
Paint Technol., **22**, 161–8, 205–210, 241–4, (1958): *Chem. Abs.*, **52**, 16756 (10 Oct. 1958)
A comprehensive discussion of the available driers, their uses and the mechanism of drying. Probably this mechanism involves free-radical reactions by electron transfer. The synergistic action of some compounds having a resonant structure is cited. The effects on drying of vehicle composition, drier concentration, atmospheric conditions, film thickness, storage time, substrate and solvents and pigments present are considered. It is suggested that a useful test procedure involves studying a proposed drier combination in the concentration and solvents of the finished paint. Colour changes occurring when Co drier is added to certain solvents etc. are tabulated and discussed. The electrochemical approach appears to be most likely to be fruitful in future work designed to elucidate the true nature of the drying mechanism.
C.O.C.

Colour and Styling
C. G. Neale
Bull. Inst. Met. Finishing, **8**, 129–142 (Summer 1958)
An account of the selection of colours in the design of motor-cars. J.W.D.

Optical Properties of Pigmented Films
R. H. Harding
Univ. Microfilms (Ann. Arbn., Mich.), *L. C. Card* No. **Mic 581-784**, 195 pp.: *Dissertation Abstr.*, **18**, 2100 (1958): *Chem. Abs.*, **52**, 16757 (10 Oct. 1958)

Calcined Clays in Paint
H. B. Naylor
Paint, Oil, Chem. Rev., **121**, (11) 6–8 (1958): *Chem. Abs.*, **52**, 15919 (25 Sept. 1958)
The properties of calcined clay lie between those of true pigments and extenders. Two grades are available one of average particle diameter 1·2 μ. and the other 0·8 μ. Addition of up to 1·5 lb. calcined clay per gal. of vehicle increases scrub resistance, beyond this scrub resistance diminishes. It is very bright and its high porosity causes difficult stain removal and high oil absorption. The viscosity of the paste before grinding is high, but falls rapidly when the paste is thinned. Typical formulae using calcined clay are given. C.O.C.

PATENTS

Marking Inks containing Glycidyl Polyethers, Rosin and Aluminium Nitrate
Westinghouse Electric Corpn. *USP* 2,836,573
Ink suitable for use on glass, ceramics, plastics and the like to give impressions free from smudge and tack and of good resistance to abrasion are produced by dispersing a pigment in a liquid solution of an epoxide resin and aluminium nitrate in a volatile solvent. Thus Epon 1001 (an epoxide resin) and aluminium nitrate are dissolved in butyl Cellosolve and then ball-milled with a pigment, rosin being added if desired to improve the air-drying properties of the ink. The impressions given by such inks are readily removed by acetone. C.O.C.

Aqueous Graphite— Poly(vinyl Alcohol) Ink
Western Union Telegraph Co. *USP* 2,833,736
Aqueous inks pigmented with Graphite (C.I. Pigment Black 10) of particle size 2–5 μ. and containing poly(vinyl alcohol) as binder are very suitable as drawing inks which do not smudge and are readily erasable. C.O.C.

Zinc–Calcium Resinate Varnishes as Printing Ink Vehicles
IC *USP* 2,825,657
Calcium hydroxide and zinc oxide are heated with rosin in a low solvency hydrocarbon solvent in a closed vessel at 250–400°F. The resulting varnish is compatible with ethyl cellulose which it will hold in solution. C.O.C.

Crayons for Use by Children
L. Aronberg *USP* 2,835,604
A non-toxic dye, e.g. a food dye, is mixed with an aliphatic amine, e.g. triethanolamine, and then a high mol. wt. fatty acid, e.g. stearic acid, added at room temperature. The mixture is heated to 100–120°C. until it becomes a clear flowing liquid whereupon it is poured into moulds to produce crayons, etc. C.O.C.

Coloured Crayons for Decorating Ceramics
R. Zgraggen *USP* 2,835,600
Crayons which can replace liquid paints even for the most delicate designs are prepared by mixing a ceramic pigment with an inorganic carrier and then pasting it with a liquid or liquefiable binder, e.g. casein, pressing the mass into thin leads, air drying and firing at 400–1000°C. Their use enables simple drawing to replace brush work.
C.O.C.

Coating Compositions
DuP *BP* 803,780
Production of sprayable non-webbing pigmented methyl methacrylate polymer coating compositions yielding smooth uniform coatings ≤ 1·5 mils thick in not more than three separate coats, is described. C.O.C.

Varnishes containing Nitrophenylazo Dyes
Sterling Drug *USP* 2,838,412
Addition of a little benzotriazole prevents discoloration caused by iron in presence of water of varnishes containing nitrophenylazo dyes, e.g. those obtained by coupling β-naphthol and a diazotised nitroaniline. C.O.C.

Mildew-resistant Paint
Pioneer Manufacturing Co. *USP* 2,837,433
Used in conjunction with ferri-ferrocyanide or ferric-ferricyanide in paints copper naphthenate does not inhibit drying but its antiseptic properties remain unaltered.
C.O.C.

Light-coloured Cellulose Nitrate Lacquers Resistant to Discoloration by Mineral Oils and Road Tar

DuP *USP* 2,838,464

Resistance to discoloration by mineral oils and greases and road tar is obtained without interference with the other important properties required of a topcoat lacquer by making the lacquer from cellulose nitrate, alkyd resin modified with 25–35% by weight of coconut oil and coconut oil fatty acids, plasticiser (of b.p. > 325°c., solubility in water < 0·005% at 25°c. and producing a cloudy mixture when mixed with its own weight of *n*-hexane) and volatile organic solvent. Suitable plasticisers are 2-ethyl hexanediol adiphate, propylene glycol sebacate, and propylene glycol adipate. C.O.C.

Improving the Stability and Resistance to Micro-organisms of Synthetic Latex

Dow Chemical Co. *BP* 804,030

Addition to synthetic latex, i.e. any aqueous colloidal dispersion of olefinically unsaturated polymers, of a water-soluble condensate obtained from 1–3 mol. of HCHO and 1 mol. of an aliphatic alkenol amine containing a straight chain made up of > 2 C and N atoms, at least one hydroxyl radical and at least one primary amino radical, e.g. condensate of 1:3-diamino-2-propanol with HCHO, results in improved stability and resistance to attack by micro-organisms. C.O.C.

Aluminium Dipping Enamel

Glidden Co. *USP* 2,827,388

Uniform, non-streaky finishes are obtained by use of an aluminium dipping enamel containing as the sole or principal film-forming material a polymeric C_4–C_6 conjugated diolefin homopolymer and/or C_4–C_6 diolefin–styrene copolymers which has been polymerised in solvent in presence of Na as catalyst, e.g. the butadiene–styrene drying oils described in *USP* 2,652,342. C.O.C.

Glass Enamelled Aluminium Foil

General Ceramics Corpn. *USP* 2,827,393

One surface of the foil is washed, coated with an aluminium enamel, dried and fired at 940–1040°F. for 2–10 min. C.O.C.

Speckled and Mottled Ceramic Glaze

Pemco Corpn. *USP* 2,835,601

A finely divided colorant is dispersed in a carrier which is transformed from being a solid to being a viscous liquid at > 120°F. Into the molten dispersion there is mixed a flux which acts as a matrix for the colorant when the mixture is cooled. It is then ground into particles of 150–10 mesh sieve, which are then used as pigments for ceramic coatings. This enables the range of colorants to be used to be much extended and so speckled or mottled glazes to be produced in colours besides blues, browns, and blacks. C.O.C.

Salts of Basic Dyes for use in Coloured Writing Inks and in Colouring Plastics (IV p. 70)

Washable Wallpaper and Lacquer for producing it (XI p. 79)

VI— FIBRES; YARNS; FABRICS

Modern Techniques in the Study of Wool Structure

F. O. Howitt

J. Textile Inst., **49**, P 236–P 241 (June 1958)

I— A review of modern views on the histological nature, chemical reactivity, and molecular structure of wool from the point of view of the methods of research used to investigate these properties.

A. Robson

Ibid., P 242–P 244

II— The review is continued with a brief summary of the methods available for the hydrolysis of wool protein and the chromatographic analysis of the resulting amino-acid mixture. The technique can be applied to the analysis of the amino-acid composition of the various fractions of wool protein. 34 references. P.T.S.

Use of Regenerated Protein Fibres in Hatter's Felts

H. G. Fröhlich

S.V.F. Fachorgan, **13**, 526–534 (Sept. 1958)

Addition of regenerated protein fibres of the Fibrolane BX (Courtaulds) and Merinova (Snia Viscosa) type to wool and rabbit hairs enhances the milling capacity, resulting in felts which are thicker but whose tear strength is somewhat reduced. Results of milling and dyeing trials are presented graphically. L.A.T.

Cold-drawing of 6,6-Nylon

D. C. Hookway

J. Textile Inst., **49**, P 292–P 316 (July 1958)

Three types of load–elongation curve can be obtained using undrawn 6,6-nylon. The type of curve obtained depends on the speed of extension, temperature, moisture content, and isotropic refractive index of the undrawn filament. From an examination of the effect of these variables on the load–elongation curves a theory of cold-drawing can be advanced. The yield stress of a high polymer sample is related to the molecular mobility of the amorphous regions, which can be altered by changes in moisture content, temperature, and density of the undrawn filament. If extension weakens a filament at the weakest point, localised draw down will occur. The temperature of the filament in the regions adjacent to the weakest point will rise so that the filament will draw at a self-sustaining neck. If, on the other hand, a small extension strengthens the fibre at its weakest point the point of draw will move to the next weakest point and so on, and the result is uniform draw. It is suggested that recrystallisation occurs after drawing. Drawn polythene recovers almost to its undrawn shape if warmed to just below the melting point. P.T.S.

Use of the Shrinkage Properties of Stretched Vinylic Fibres in Blends

J. M. Alibert

J. Textile Inst., **49**, P 506–P 514 (Sept. 1958)

During manufacture vinylic fibres and yarns are stretched at about 100°c. If the temperature of the yarn or fibre is raised again to 75–80°c. contraction occurs slowly; at 100°c. it is practically instantaneous and can be as much as 55% of the original length. Curves are given showing the shrinkage of Rhovyl in 10 min. at different temperature, the shrinkage of Rhovyl at 80°c. and 95°c. after different times and the shrinkage of blends. The uses of this shrinkage property in uniform cloths, car-top fabrics, and knitted fabrics is discussed. P.T.S.

PATENTS

Acetylating Cyanoethylated Cotton

American Cyanamid Co. *USP* 2,825,623

Cyanoethylated cotton is treated with acetic anhydride to introduce < 0·3 mole of acetyl group per anhydro-glucose unit. The fibre structure remains unaltered and elongation and tenacity are little affected. C.O.C.

Sodium Oxalate as Protective Agent during the Steaming and Bleaching of Regenerated Protein Fibres

Virginia–Carolina Chemical Corpn. *USP* 2,828,181

Incorporation of 1–4% of sodium oxalate in the aqueous baths used in the processing of regenerated protein fibres results in substantial reduction in the deterioration in the mechanical properties normally experienced. C.O.C.

Halogenoethylenic Polymers having Enhanced Dye Receptivity

Dow Chemical Co. *USP* 2,827,443

A halogenoethylenic monomer and at least one other monomer containing pendant basic groups are dispersed in an aqueous polymerisation medium containing a catalyst and an acid to neutralise the basic groups attached to the monomers; and the dispersion subjected to polymerising conditions. Thus vinylidene chloride, acrylonitrile, and 2-methyl-5-vinyl pyridine were dispersed in water containing lauroyl peroxide, methyl hydroxy propyl cellulose and, as chain transfer agent, lauryl mercaptan. The whole was heated to 55°c. to effect polymerisation. The product was dark brown and insoluble in acetone. The process was repeated but with the addition of acid to centralise the basic groups, the resulting product was pale yellow, soluble in acetone and could be formed into fibres capable of being dyed with acid dyes. C.O.C.

Dyeable Acrylonitrile Copolymers

Hercules Powder Co. *USP* 2,826,560

The copolymers of acrylontrile with base-catalysed polymers of acrylamide or α-alkylacrylamides (i.e. products obtained when compounds of formula CH_2:CAlk·CO·NH_2 are polymerised in presence of a strong basic catalyst) are readily dyed and do not have the lowered softening point, loss in strength or increased sensitivity to water as do other copolymers of acrylonitrile. C.O.C.

Lubricating Metal-coated Glass Fibres

Owens-Corning Fiberglas Corpn. *BP* 804,301

Metal-coated glass fibres are rendered easier to handle by treating them with a reagent which modifies the metal surface, e.g. which oxidises or etches the metal, and then with a lubricant, e.g. paraffin or a hard metal. C.O.C.

Asbestos-like Fibrous Alkali Metal Titanates

DuP *USP* 2,833,620

Fibrous, water-insoluble, non-hydrated alkali metal titanates are obtained by treating a water soluble basic oxygen-containing compound of an alkali metal of atomic number > 10 with TiO_2 in molar ratio 1:6 to 12:1 (calculated as alkli metal oxide:TiO_2) at $< 400°$c. and < 200 atoms. Thus anatase TiO_2 (0·1329 part) NaOH (0·0665) and water (0·1665) heated to 625°c. under 2800 atms. for 25 min. The resulting solid product was composed entirely of fibres about 25 μ. long and length:diameter ratio of 100:1. C.O.C.

Colourless Aqueous Saline Solutions of Polyacrylonitrile (III p. 61)

Deep Black Pigmented Yarn (VIII p. 75)

VII— DESIZING; SCOURING; CARBONISING; BLEACHING

Effect of Hardness of Water on the Soil-removing and -suspending Power of Sodium Carboxymethylcellulose

K. J. Nieuwenhuis and K. H. Tan

Teintex, **23**, 629–648 (Sept. 1958)

Water-hardness affects both the removing and suspending powers of Na C.M.C. (I). Low soap content and approx. 100 mg. (I) per litre are less affected than high soap content and no (I), tested in waters of 0–20° French hardness. In soft water the increase in removing power with addition of (I) is most marked with low soap concentrations, but in the same medium the soap concentration has hardly any influence on the suspending power. S.R.C.

Microscopic Studies of Detergency— Dirt Removal from Various Fibres

R. E. Wagg and G. D. Fairchild

J. Textile Inst., **49**, T 455–T 463 (Sept. 1958)

The effect of variation of detergent, additive, pH, and temperature on the removal of fatty compounds from cellulose acetate, viscose rayon, nylon, silk, Terylene, cotton, flax, and wool has been studied with the microscope. The detergents used include an ethylene oxide condensate, a sulphonated hydrocarbon, an arylalkyl sulphonate, sodium oleate, a secondary alkyl sulphate, sodium metasilicate, sodium sesquicarbonate. The contact angle and the time for complete removal of dirt from each fibre–detergent combination is recorded. P.T.S.

PATENTS

Reducing the Ash Content of Cellulose

Columbia Cellulose Co. *USP* 2,825,646

Washing with an aqueous solution of an aldohexonic acid (i.e. those of formula $HOCH_2(CHOH)_4COOH$), its lactone or its salt considerably reduces the ash content of cellulose. C.O.C.

Bleaching Wood Pulp

Rohm & Haas *USP* 2,826,478

Enhanced brightness is obtained when bleaching with hydrosulphite if it is carried out at pH 4·5–6·0 in presence of an alkali metal citrate and, if desired, an alkali metal tetraborate. Presence of iron or other metals does not interfere with the improvement obtained by the use of the citrate. C.O.C.

Continuous Bleaching of Cellulosic Fabrics

ICI *BP* 803,796

The fabric is first treated with tri- or perchloroethylene, then given a quick treatment with hot alkaline hypochlorite solution and finally desized with a peroxygen compound by the method of *BP* 747,481 (J.S.D.C., **72**, 363 (1956)). Thus 7 oz./sq.yd. loomstate cotton duck was passed at open width through boiling trichloroethylene for 30 sec. It then passed for 20 sec. through water at 85–95°c. to remove the solvent and then for 2 min. through NaOCl solution (2 g. available Cl per l.) at 75°c. and pH 11. This was followed by rinsing in cold water, mangling and padding with 1·5 times its weight of an aqueous solution containing, per litre, 15 g. sodium peroxide, 5 g. sodium silicate and 0·5 g. of an octylated cresol–ethylene oxide condensate, steamed for 150 sec. and rinsed in hot and then cold water. This yielded a good white cloth free from cottonseed and starch, of excellent wettability and fluidity 5·9. C.O.C.

High Speed Peroxide Bleaching of Cellulosic Materials

DuP *USP* 2,839,353

Rapid and efficient bleaching is obtained by impregnating the goods with an aqueous solution of a peryoxygen compound and then heating to well above 212°F., e.g. at 290–325°F. Thus desized cotton muslin was impregnated with its own weight of a solution containing 0·9% H_2O_2, 1% of 42° Bé sodium silicate and enough NaOH to bring to pH 10·7. The impregnated cloth was immediately treated in an autoclave with live saturated steam at 300°F. for 30 sec., washed and ironed. The treated material had a good white and absorbency. C.O.C.

Sodium Oxalate as Protective Agent during the Steaming and Bleaching of Regenerated Protein Fibres (VI p. 73)

VIII— DYEING

Diffusion of Direct Dyes through Regenerated Cellulose Film

B. N. Mel'nikov and P. V. Morÿganov

Izvest. Vysshikh Ucheb. Zavedenii, Khim. i Khim. Tekhnol. (1), 157–163 (1958): *Chem. Abs.*, **52**, 15197 (25 Sept. 1958)

The effect of triethanolamine as a dispersing agent on the diffusion of direct dyes through regenerated cellulose film is due to the solvent action of triethanolamine on the dyes. The diffusion coefficient of three direct dyes, Direct Blue K, Direct Diazo Black C, and Direct Sky Blue, through regenerated cellulose films under the same conditions at 45, 55, 65, and 75°c. and with 50, 100, and 150 g./l. of triethanolamine are given. As a rule presence of triethanolamine increases the dyes diffusion coefficient by 5–8 times. Swelling of the film is not appreciably affected by presence of triethanolamine but formation on the film's surface of adsorption layers of triethanolamine is possible and this aids acceleration of diffusion of the dye through the film. This is true of Direct Sky Blue at all temperatures but only at 45°c. for the other two dyes. C.O.C.

Progress in Application of Vat Dyes in Dyeing and Printing

L. M. Goloms

Khim. Nauka i Prom., **3**, 225–231 (1958): *Chem. Abs.*, **52**, 16745 (10 Oct. 1958)

Review, 93 references. C.O.C.

Dyeing of Polyamide Fibres with Sulphur Dyes

W. Titzka and C. Klopfstock

Textil Praxis, **13**, 925–927 (Sept. 1958)

Methods are described for the application of sulphur dyes to nylon and nylon–cotton anions, where high standards of fastness to light, washing, and rubbing are required. The material is pretreated with tannic acid in the presence of an organic or inorganic acid, and a dispersing agent. After intermediate drying, sulphur dye, in its leuco form, is applied and reoxidised in the usual manner. Stretch nylon yarns were successfully dyed with sulphur dyes and exhibited good fastness to subsequent heat-treatments. L.A.T.

PATENTS

Deep Black Pigmented Yarn

Celanese Corporation of America *USP* 2,839,420

When mass dyeing any kind of filament-forming material with Carbon Black (C.I. Pigment Black 7) addition of a little of an inert white pigment, preferably titanium dioxide (C.I. Pigment White 6) improves the depth of the resulting black. C.O.C.

Water-in-oil Emulsions of Vat Dyes and their Use in Dyeing

BASF *BP* 804,032

In preparing emulsions of aqueous dispersions vat dyes in a water-immiscible liquid (< 25% by weight of the emulsion) of boiling range 60–220°c. by use of < 30% of a nonpolymerisable emulsifier more soluble in the oil than the water better results are obtained in using the emulsion if the emulsifier is such that its surface activity is so altered by the action of alkali and if necessary, reducing agents, that the oil-solubility is altered into water-solubility. Thus an aqueous suspension (88) containing Indanthren Red FBB (C.I. Vat Red 10) (0·4), Indanthren Blue (C.I. Vat Blue 30) (0·6), Indanthren Brown LG (C.I. Vat Brown 46) (0·2), and NaCl (5) is emulsified into a mixture of the dimethyl palm-kernel fatty amine dodecylbenzene sulphonate (4) and aliphatic hydrocarbons (8) of cooling range 140–200°c. Cotton cloth is then slop padded with the emulsion, dried and developed by "pad–steam" in a reducing liquor containing 70–100 ml. of NaOH 30° Bé and 35–80 g. of sodium dithionite per litre and finally re-oxidised. Dyeings of excellent uniformity and penetration are obtained. C.O.C.

Dyeing Wool with Metallised Azo Dyes

DuP *USP* 2,835,550

Level, well penetrated dyeings are obtained when wool cloth is dyed with neutral dyeing, metallised azo dyes in absence of large amounts of mineral acid but in presence of compounds which release acid during dyeing. If the wool has not been treated before dyeing with a polyoxyalkylene glycol then such a compound must also be present in the dyebath. Thus wool was dyed with the grey dye 2-aminophenol-4-sulphonamide → 8-acetamido-2-naphthol, Cr/2 with addition of ammonium sulphate and a 10–22% polyoxypropylene glycol and 90–78% polyethylene oxide condensate of mol.wt. 7000–9000. C.O.C.

Dyeing Cellulose Triacetates, Acrylic and Polyester Fibre

Courtaulds *BP* 803,293

Disperse dyes are applied using a *cyclo*hexylphenol as carrier. Thus deeper dyeings are obtained on cellulose triacetate with Serisol Fast Red BGL (YDC) in presence of *p*-menthylphenol than in its absence. C.O.C.

Dyeing Polycster and Cellulose Triacetate Fibres

DuP *USP* 2,833,613

Level, heavy dyeings of good light fastness are obtained without spotting by use of aqueous baths of disperse dyes at 100°c. using as carrier a mixture of dimethyl terephthalate and benzanilide (1:3–3:1 by weight), there being < 2 parts of the mixture per 1000 parts of dye liquor. This mixture is normally insoluble in water but if ground to < 100 mesh (U.S. sieve size series) it is readily soluble to yield 2% solutions. C.O.C.

Treating Polyesters with Dioxane to Improve their Dyeability

Chemstrand Corpn. *BP* 803,774

Treating Terylene or other polyester material with dioxane at 85–101·5°c. much increases the affinity for disperse, direct, and vat dyes. Thus Terylene fabric was treated for 30 min. in reagent grade dioxane at 90°c., rinsed in water and dried. It yielded much deeper dyeings with Eastman Blue GLT (TE) than did an untreated fabric, the two dyeings being equivalent as to fastness. C.O.C.

Mordant Dyes (IV p. 65)

IX— PRINTING

Attempts to reduce the Amount of Rongalite required in Printing

H. Fritzsch

Deut. Textil tech., **8**, (5), 257–8 (1958): *Chem. Abs.*, **52**, 16745 (10 Oct. 1958)

Normally excess Rongalite is used in 2-phase printing with vat dyes. Extensive trials with 12 thickeners and 16 dyes showed that proper choice of thickener enables reduction of the amount of Rongalite needed by 30% or more. C.O.C.

Reproduction of Colour

R. W. G. Hunt

Research, **11**, 432–8 (Nov. 1958)

Review of the history of and methods now in use for reproducing colour with particular reference to photography, television, and printing. C.O.C.

PATENTS

Urea as Printing Assistant

Courtaulds *BP* 804,120

Prints are made with a paste consisting of dye, thickener, and urea, or a mixture of urea with substances soluble in urea and capable of lowering the m.p. of urea, dried and then baked between the m.p. of the urea or urea solution and 160°c., washing the urea away and drying. Any dyes soluble in molten urea can be used, e.g. direct, disperse, leuco ester of vat dyes, acid dyes, and metal complex dyes. Thus cellulose triacetate knitted fabric, Terylene fabric, and acetate rayon fabric were screen printed with a paste made up of Dispersol Yellow G 300 (C.I. Disperse Yellow 3) (2 parts), 25% Nafka crystal gum (46), urea (50), and water (100), dried, baked at 140°c. for 4 min., washed in 0·02% soap solution at 40°c. for 30 min. and dried. In all three cases excellent prints were obtained. C.O.C.

Oil-in-water Resin Emulsion Pigment Printing Colours

Gy *USP* 2,825,708

Colour concentrates containing up to 20% of organic pigment or up to 40% of inorganic pigment are obtained by first forming a slurry containing a deflocculated pigment, water, a fatty alcohol sulphate, and an emulsifying agent. A resinous polyester containing esterified polyunsaturated fatty acid esters is then emulsified in the slurry. C.O.C.

Oil-in-water Emulsion Textile Printing Extender Pastes

Gy *USP* 2,825,707

A mixture of (1) an aqueous emulsion containing 40–60% by weight of a hydrocarbon solvent and 0·3–0·8% of a cellulose ether which in 2% aqueous solution has viscosity < 1200 cps. at 20°c. and (2) an aqueous emulsion of a water-immiscible organic solvent solution of a water-insoluble amine–aldehyde resin and/or an elastomer latex formed by a homopolymer of vinyl chloride, *iso*butylene, and chloroprene or a copolymer of vinyl chloride and vinyl acetate or butadine and acrylonitrile, used as an extender paste for colour concentrates, results in pinks of good fastness to rubbing. C.O.C.

Discharge Printing on Mass-coloured Regenerated Cellulose

J. P. Bemberg *BP* 804,056

Filaments are produced from viscose containing one or more water-insoluble dyes which are destroyed by strong reducing agents. They are then made up into fabrics which, on being printed with a suitable discharge, exhibit discharge effects on an extremely fast ground. Thus the dye obtained by coupling Fast Black Salt G (C.I. Azoic Diazo Component 49) with C.I. Azoic Coupling Component 17 is dispersed in a viscose spinning solution. Filaments obtained from this solution are made up into fabric on which discharge effects may be obtained by printing with sodium hyposulphite. C.O.C.

Polyamines as Short Stop Agents for Azine Colour Developers

General Aniline *USP* 2,827,375

An aqueous solution of a polyamine, e.g. 1–5% of hexamethylene tetramine, when used as a short stop bath after development of an azine dye image and before further processing, effectually avoids any formation of stain or colour development fog. C.O.C.

Pigment Printing
Ciba *BP* 803,647

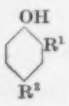
Use of hardenable epoxides of a compound containing at least two hydroxyl groups gives prints of good resistance to abrasion without imparting stiffness. Thus a toluene solution of the polyepoxide obtained by treating 4:4′-dihydroxydiphenyldimethyl methane with epichlorohydrin by the method of *BP* 739,701 is pigmented with C.I. Pigment Blue 15 (previously dispersed in hydrogenated colophony glycerine ester) and a little triethylene tetramine added. The resulting paste is roller printed into glass fabric. After drying and hardening at 180°C. for 20 min., there is obtained an elastic blue print of good covering power, fastness to rubbing and very good adhesion and which is unaffected by boiling for 30 min. in a solution containing 5 g. soap and 2 g. Na_2CO_3 per litre of water. C.O.C.

Decoration of Ceramic and similar Ware
F. Malkin & Co. *BP* 803,485

Modification of *BP* 746,070 (J.S.D.C., **72**, 256 (1956)) A flexible endless band coated with the printing paste passes between a pad bearing the design to be imparted and a member which supports the band when the pad is moved into contact with it. This support is arranged to leave the central part of the surface of the band with which the pad engages free to yield to the pad pressure so that when the pad presses against the band the latter adapts itself to the contour of the pad. C.O.C.

Solvents for Colour Couplers
Eastman Kodak Co. *USP* 2,835,579

Compounds of formula—



(R^1 and R^2 = same or different, $-(CH_2)_nCH_3$ or one of them = $-CO(CH_2)_nCH_3$ (n = 0–17; $n + n$ = 7–17)), e.g. 2:4-di-*n*-amylphenol, when used as solvents for colour couplers for addition to photographic emulsions neither become discoloured nor do they cause fading of the dyes formed from the couplers. C.O.C.

Copolymeric Mordants for Acid Dyes for use in Photographic Emulsions
DuP *USP* 2,839,401

Polymeric substituted or unsubstituted acrylic acid esters of amino alcohols having tertiary and quaternary salt groups in the proportion of 35–75% of the former to 65–25% of the latter are mordants for acid dyes. They are non-diffusing in photographic silver halide emulsions and have no deleterious action on the silver halide grains. C.O.C.

Dyed Relief Records
Technicolor Corpn. *USP* 2,837,430

Film sensitised with a silver halide is exposed, a silver image developed and the film hardened in the region of the developed silver. The unhardened film is then etched off and the bold portion of the film dyed. Na thiosulphate is used as the hardener in the developer to prevent the film being etched clean through in the highlights. C.O.C.

Progress in Application of Vat Dyes in Dyeing and Printing (VIII p. 74)
Inlaid Embossed Fabrics (X p. 77)
Stencil Paper for Auxiliary Photographic Negatives (XI p. 79)

X—SIZING AND FINISHING

PATENTS

Preventing Liberation of Formaldehyde from Textiles Treated with Formaldehyde Resins
American Cyanamid Co. *USP* 2,833,670

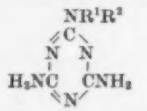
Resin-finished textiles able to liberate > 0·3% of formaldehyde on the weight of the fabric when stored for 20 hr. at 100°F. and 100% RH are treated with sufficient of a formaldehyde acceptor, e.g. urea, to reduce the liberated formaldehyde to < 0·3%. C.O.C.

Imparting Ability to Recover from Creasing to Cotton and Rayon
Shell Development Co. *USP* 2,826,514

The fabric is impregnated with an aqueous solution of an alkanedial of 5–8 C and, as catalyst, a metal salt of an inorganic acid, and preferably a polyhydric alcohol, and then dried and baked. The treated fabric shows little loss of colour and strength, no ability to retain chlorine, a soft handle and excellent resistance to abrasion. Thus viscose rayon impregnated with an aqueous solution of glutaraldehyde and Mg perchlorate, dried at 60°C. and baked at 160°C. had good recovery from creasing, no chlorine retention, good washability, and soft handle. Similar treatment but with addition of glycerol to the bath resulted in much whiter colour and better resistance to discoloration after bleach and scorching. C.O.C.

Imparting Dimensional Stability and Recovery from Creasing to Cellulosic Textiles
Rohm & Haas Co. *USP* 2,833,674

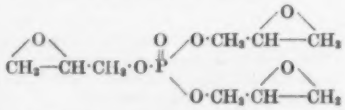
Treatment with a condensate of formaldehyde with melamine, urea, *NN′*-ethyleneurea, and *NN′*-trimethyleneurea in presence of 5–85 mole % of a formaldehyde condensate of a compound of formula—



(R^1 and R^2 = same or different, allyl, hydroxyethyl or Alk of 1–3 C), e.g. trimethylol-*NN*-dimethylamine yields a finish which has extraordinary slight yellowing tendency on chlorination and very low loss of strength on ironing after chlorination. C.O.C.

Epoxy Ester of Phosphorus Containing Acids for Imparting Ability to Recover from Creasing and Dimensional Stability
Shell Development Co. *USP* 2,826,592

The fabric is impregnated with an aqueous solution or dispersion of a phosphoric ester or acid ester containing > 1 acidic group, or derivatives of them obtained by replacing the O atom attached to the P atom with a dissimilar chalkogen, all the acid groups are esterified, two of them at least with an alcohol containing at least one group, in presence of an epoxy curing agent, dried and baked. Thus cotton cloth was impregnated with an aqueous solution of tri(2:3-epoxypropyl) phosphate—



containing Zn fluorborate as catalyst, dried at 100°C. and baked at 160°C. The finished cloth has good recovery from creasing, good washability, no chlorine retention, and improved resistance to fire. C.O.C.

Mildewproofing Cellulose by Etherifying, Esterifying, and Quaternising the Cellulose
P. W. Kersnar *USP* 2,833,614

Treatment occurs in seven steps: (1) wetting out with aqueous alkali, (2) treating with an epoxide, (3) neutralising with dilute sulphuric acid, (4) rinsing free of salts and acid, (5) drying, (6) esterifying with an aromatic sulphonyl chloride, e.g. benzene sulphonyl chloride, and a tertiary amine, e.g. trimethylamine, and (7) heating with a tertiary amine, e.g. trimethylamine, to form the cellulose quaternary ammonium sulphonate. This gives a permanent mildewproof without impairing the tensile strength, causing increase in weight or interfering with subsequent dyeing. C.O.C.

Dimensional Stabilisation of Protein Textiles
Rohm & Haas *USP* 2,827,359

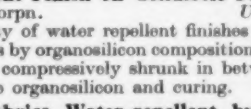
Treatment with an aqueous dispersion of a water-insoluble linear copolymer of 4-vinyl pyridine (< 3% by weight) and a monoethylenically unsaturated monomer, e.g. *n*-butyl acrylate, improves the resistance to abrasion of protein textiles and is highly effective in conferring dimensional stability against laundering. C.O.C.

Water Repellent Finish on Cellulosic Fabrics
Dow Corning Corpn. *USP* 2,833,022

The durability of water repellent finishes produced on cellulosic fabrics by organosilicon compositions is improved if the fabric is compressively shrunk in between impregnation with the organosilicon and curing. C.O.C.

Rendering Fabrics Water-repellent by treatment with Amidomethyl Quaternary Ammonium Siloxanes
Dow Corning Corpn. *USP* 2,838,423

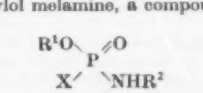
Quaternary amidomethyl siloxanes of unit formula—



(R^1 = aliphatic hydrocarbon of < 4 C; $c = 0$–3; $a = 1$ or 2; R^2 = di- or trivalent satd. aliphatic or *cyclo*aliphatic hydrocarbon of > 1 C; Y = monovalent hydrocarbon or fluorinated hydrocarbon; $m = 0$–2) are useful for producing a water-repellent finish on cotton which will resist laundering at 160°F. They are prepared by treating a siloxane amide of formula $(H_2NOC)_aR^2SiO_{\frac{3-m}{2}}Y_m$ with the hydrochloride of pyridine (or a substituted pyridine) and HCHO. C.O.C.

Flame-resistant Finish of Good Fastness to Washing
American Cyanamid Co. *USP* 2,828,228

Cellulosic textiles are impregnated in an aqueous bath containing methylol melamine, a compound of formula—



(R^1 = Alk, alkoxyalkyl or halogenated alkyl or 1–4 C; R^2 = H or Alk of 1–4 C; X = $-OR^1$ or NHR^2) and a catalyst, dried and baked. There is no loss in tensile strength and the finish is fast to repeated severe launderings. C.O.C.

Rendering Cellulosic Materials Flame Resistant
Shea Chemical Corpn. *USP* 2,832,745

Cellulosic materials are given a flame resistant finish fast to laundering by impregnating them with a composition made up of (1) a compound of formula $R^1O{\cdot}PONH_2{\cdot}OR_2$ or $R^1O{\cdot}PO(NH_2)_2$ (R^1 and R^2 = same or different Alk or halogenoalkyl; $R^1 + R^2$ benz of < 8 C), (2) the adduct of a compound of formula CX_2YZ (X = Cl or Br; Y + Z = H, Cl or Br) with either a polymerisable neutral unsaturated alcohol ester of phosphoric acid or of an alkene phosphonic acid, and (3) a polymethyl amide, azine or azole. Thus diethyl phosphoramidate (1 part) and trimethylol melamine (1) were dissolved in water. To this solution was added an equal weight of an emulsion made by mixing triallyl phosphate (252), bromoform (163), K persulphate (12·5), polyvinyl alcohol (85) Na_2CO_3 (22·5) and water (850) and warming at 85–90°C. for 150 min. The resulting mixture was brought to pH 5–6 with phosphoric acid. Cotton cloth was impregnated with this mixture, cured for 3 min. at 160°C. and dried at 80°C. It was flame resistant even after 20 launderings. C.O.C.

Permanent Waving
Arthur D. Little *USP* 2,836,185

A mixture of a water-soluble sulphite and a water-soluble amide or imide, e.g. $NaHSO_3$ and urea or formamide can be used at room temperature, is odourless and damages the hair less and shows less "wash-out", i.e. retains the curl over a larger number of washings, than do the thioglycolate solutions.

USP 2,836,543

Addition of a polyfunctional aromatic compound, e.g. gentisic acid, shortens the time needed for treatment. C.O.C.

Antistatic Finish
N.V. Onderzoekingsinstituut Research *BP* 803,174

Modification of *BP* 791,476 (J.S.D.C., **74**, 500 (1958)) better fastness to wet rubbing being obtained if an organic cation-active substance and/or a polyalkylene polyamine is present in the bath. C.O.C.

Inlaid Embossed Fabrics
Joseph Bancroft & Sons Co. *USP* 2,838,416

An embossing calender is used in which the steel roller has the pattern sunk in its surface and the composition roller has the pattern raised on it. Colour paste is applied to the raised portions of the soft roller by a printing roller placed before the nip and from this roller it is transferred to the sunk portions of the steel roller. As the steel roller does not exceed 200°F. in normal operation this procedure renders possible the use of aqueous dispersions of pigments, resins, etc. Thus pure cellulosic fabric is impregnated with 80% methylated methylol melamine (80 lb.), Aheovel G (*s*-di(1-(2-stearamidoethyl(mono acetate) (15 lb.), methylhydroxy propanolamine hydrochloride (12) and water (to make 100 gal.), squeezed to 10% pickup, partly dried, and embossed and inlaid with a paste made up of 11% polyvinyl alcohol (45 parts), 80% methylated methylol melamine (8), Aheovel G (2), methylhydroxy propanolamine hydrochloride (2), Aridye Pigment Padding Blue 2G (4), ammonia (1), and water (38). The fabric is then baked for 3 min. at 300°F., washed and dried. This yields an embossed fabric having blue depressed areas, both embossing and colour being fast to repeated washing and dry cleaning. C.O.C.

Imparting Dimensional Stability and Water Repellency to Wool Textiles
Shell Development Co. *USP* 2,829,071

The wool is impregnated in an aqueous bath containing a polyether polyepoxide, particularly a glycidyl polyether of a polyhydric alcohol, and an amine catalyst, dried and baked. Thus flannel impregnated with an aqueous dispersion of the polyether obtained from glycerol and epichlorohydrin and having mol.wt. 324 and epoxide value of 0·671 equivalent per 100 g., the dispersion also containing polyvinyl alcohol and, as catalyst, diethylene triamine, dried at 100°C. and then baked at 160°C. had a soft handle, outstanding resistance to shrinking and improved water repellency. C.O.C.

Fabric containing a Kinky Wool Pile
Specialties Development Corpn. *USP* 2,837,809

Wool ply yarn composed of twisted plys is stretched while wet at a tension between 25–100% of its wet breaking strength, wound while wet and still stretched, and dried while wound. It is then used as the pile constituent of a fabric, e.g. by weaving, knotting or tufting. When the the resulting fabric is wet out the pile becomes kinky and resilient. C.O.C.

Durable Finish containing Neomycin
American Cyanamid Co. *USP* 2,830,011

Neomycin is substantive to wool, cotton, and similar textile fibres. Goods treated with it retain antibiotic properties even after cleaning or manufacturing and finishing processes even at elevated temperatures. Light, even on prolonged exposure, has little effect on the antibiotic finish. C.O.C.

Rendering Nylon Bacteriostatic
Weco Products Co. *USP* 2,836,516

The nylon is treated in a solution containing water (100 ml.), alcohol of 1–4 C (80–120 ml.), a phenyl mercuric compound (4–10 g.) and boric acid ($\ll$ 2·0 g.), e.g. 50 ml. water, 50 ml. alcohol, 3 g. phenyl mercuric acetate and 1·7 g. boric acid. The finish is very resistant to wet abrasion. C.O.C.

Sizing Nylon with Coal Acid Compounds
Dow Chemical Co. *USP* 2,826,515

Nylon sized with a plastified film of the mixed aromatic acid compounds obtained by the oxidation of coal is readily desized by scouring with ordinary detergents. The size is inert to nylon and to the machinery with which it comes in contact. C.O.C.

Antistatic Finish for Polymers and Copolymers of Vinyl Chloride, Vinylidene Chloride, Acrylonitrile or Chlorinated Polyethylene
Dow Chemical Co. *USP* 2,832,697

The goods are treated with $\ll$ 80% H_2SO_4, oleum containing $<$ 20% by weight of dissolved free SO_3, anhydrous solutions of oleum containing $\ll$ 20% of dissolved free SO_3, and free SO_3, and then with an antistatic agent of the type described above.

USP 2,832,698

The antistatic agent contains hydrophilic but no hydrophobic groups, e.g. glucosamine. C.O.C.

Relief Effects on Textiles containing both Nylon and Polyester Fibres
Societe Rhodiaceta *BP* 804,151
Material containing wholly or partly shrunk nylon together with polyester fibres which can shrink more than the nylon is heated to $< 180°C$. This results in a relief effect, the nylon being in relief with respect to the polyester fibres. C.O.C.

Restoring Whiteness to Yellowed Nylon Fabrics
Clorox Co. *USP* 2,830,868
Treatment with a hypochlorite solution containing 200–800 p.p.m. available chlorine and brought to pH 7·70–8·70 with a weak organic acid for 15–40 min. restores whiteness to yellowed nylon. Treatment at lower or higher pH results in the fabric losing in strength and no better whitening is obtained. C.O.C.

Improving the Adhesion of Butyl Rubber to Fibrous Materials
Esso Research & Engineering Co. *BP* 803,182
The fibrous material is first coated with a phenolic–aldehyde resin, preferably resorcinol formaldehyde resin, and then with a chlorinated butyl rubber of Cl content from 0·5% by weight to $>$ 1 atom of Cl per molecule of multi-olefin present in the butyl rubber. C.O.C.

Linear Polymers united through Ionic Cross Linkages and through Covalent Cross Linkages for use as Fabric Coatings
DuP *USP* 2,832,747
Polymeric materials comprising at least two oppositely charged ionic polyelectrolyte polymers united through both a number of ionic cross linkages and a number of covalent cross linkages when applied to fabric yield coatings of high moisture permeability, high wet strength, and good dimensional stability. Thus Na polymethyacrylate was treated in aqueous solution at 0°c. with sufficiently epichlorohydrin to react with one-fifth of the Na carboxylate groups, for 6 hr. The resulting solution was mixed with aqueous poly-β-methacrylyloxyethyltriammonium methylsulphate and the resulting white elastic gum was freed with water of Na methyl sulphate. It had the water vapour permeability of a good shoe-upper leather. Pressed into nylon or cloth at room temperature, air dried and repressed at 70°c. for 10 min. it yielded an insoluble coating having good anchorage. C.O.C.

Water-insoluble Homogeneous Polymer Blends of a Water-insoluble, Water-dispersible Nonelectrolyte Film-forming Polymer with Water-soluble Linear Organic Polymers united by Ionic Cross Linkages for use as Fabric Coatings
DuP *USP* 2,832,746
Polymer blends comprising at least two oppositely charged ionic polyelectrolyte polymers united through a number of ionic cross linkages and $< 10\%$ (by weight of the blend) of a water-insoluble, water-dispersible, nonelectrolyte film-forming polymer when applied to fabric yield a coating which is moisture permeable and is dimensionally stable, tough and pliable at low R.H. Thus a blend of polychloroprene, sodium polyacrylate and poly-β-methacrylyloxyethyltrimethylammonium methyl sulphate while still moist was milled with ZnO (C.I. Pigment White), micronised sulphur, thiocarbanilide and Carbon Black (C.I. Pigment Black). The milled product was immediately calendered onto cotton cloth, air dried and pressed for 20 min. at 100°c. under a platen having a leather-like grain. The resulting embossed coated fabric was quite pliable and tough and had good moisture permeability. C.O.C.

Lanolin Finish for Nylon Hosiery
W. F. Doyle and D. L. Copenhaver *USP* 2,832,518
After being rinsed after dyeing the hosiery is treated with an aqueous emulsion of lanolin and then boarded in the usual manner. This results in hosiery of markedly superior smoothness, softness, and flexibility. C.O.C.

Improving the Adhesion of Butyl Rubber to Textiles
United States Rubber Co. *USP* 2,839,443
Butyl rubber readily adheres to textiles if it is first partly vulcanised, preferably with the resinous self-condensate, a 4-hydrocarbon-6:6-dimethylolphenol (obtained by treating a *p*-substituted phenol having two *ortho* positions unoccupied with considerable molar excess of HCHO). C.O.C.

Antistatic Finish for Polyethylene
Dow Chemical Co. *USP* 2,832,696
The surface of polyethylene is destaticised by treating it with 98% H_2SO_4, oleum, anhydrous solution of oleum containing free SO_3, and free SO_3 and then applying an antistatic agent containing both hydrophilic and hydrophobic groups and a functional basic N atom, e.g. G 3780 (Atlas Powder Co.) (a fatty acid amine-polyoxyethylene condensate).

USP 2,832,699
The antistatic agent used contains hydrophilic but no hydrophobic groups, e.g. glucosamine. C.O.C.

Ink Transfer Ribbons
Burroughs Corpn. *USP* 2,833,666
Method and apparatus for inking and slitting typewriter ribbons, etc. to produce ribbons which do not unravel at their edges and without ink from the fabric fouling the slitting mechanism. C.O.C.

Treating Textiles to be Impregnated with Rubber
American Viscose Corpn. *USP* 2,838,455
Application of saturated fatty acids of > 15 C esterified by hexahydric alcohols or the anhydro derivatives of such alcohols to rayon yarn increases the oven-dry strength of tyrecords produced from them but it also renders the cords incapable of picking up enough latex to prepare them properly for incorporation into rubber goods. This defect is removed if a liquid polydialkylsiloxane of formula—

$$R\text{–}\left[\begin{matrix}R\\ Si\cdot O\\ R\end{matrix}\right]_x\text{–}SiR_3$$

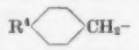
(x = 80–800) is added to the esters. C.O.C.

Coloured Laminated Cloths
Courtaulds *BP* 804,264
A laminated fabric formed by heat and pressure contains at least one layer of a coloured fabric and a fusible interlining of mass-dyed polythene threads whose colour matches that of the coloured fabric. C.O.C.

Bacteriostatic Non-woven Fabrics
Chicopee Manufacturing Corpn. *USP* 2,837,462
Compounds of formula—

$$\left[\begin{matrix}R^2\\ R^1\cdot N\cdot R^3\\ R^3\end{matrix}\right]^+ An^-$$

(R^1 = Alk, heterogeneous aliphatic of 8–18 C or



(R^4 = Alk of 8–18); R^2 = Alk of 1 or 2 C; R^3 = CH_3, C_2H_5, allyl or benzyl; An = anion), e.g. di-*iso*butyl cresoxy ethoxy ethyl dimethyl benzyl ammonium chloride, when used with the adhesives used in producing non-woven fabrics, impart a bacteriostatic finish which is resistant to wet abrasion. C.O.C.

Magnesium Chloride as the Sole Curing Agent for Aminotriazine-Aldehyde Resins: Antistatic Finish on Hydrophobic Fibres (III p. 60)
Epoxy Resin Finish (III p. 60)
Organopolysiloxanes for Water-repellent Textiles (III p. 60)
Sodium Oxalate as Protective Agent during the Steaming and Bleaching of Regenerated Protein Fibres (VI p. 73)
Lubricating Metal-coated Glass Fibres (VI p. 74)

XI— PAPER AND OTHER CELLULOSIC PRODUCTS

Recent Investigations of the Structure of Cellulose and Linear Polymers
K. Hess
Chim. et Ind., **80**, 129–139 (Aug. 1958)
Recent studies suggest that amorphous regions are not randomly distributed. The cellulose fibre is built up of a periodic sequence of ordered and disordered regions and a lateral order is found at right angles to the fibre axis. The periodic sequence has been studied by small angle X-ray diffraction and by sorption of iodine or thallium in the disordered regions. Both methods give similar results. W.R.M.

Acetylation and Nitration of Cellulose utilising Sulphamic Acid as a Catalyst
M. Isozaki and N. Ishikawa

II—Vapour-phase Acetylation with Acetic Anhydride

Rept. Govt. Chem. Ind. Research Inst. Tokyo, **53**, 155–158 (xvii) (May 1958)

Viscose rayon is treated with aq. soln. of sulphamic acid, sulphamic acid and urea, and ammonium sulphate and urea, squeezed to ½ vol., dried at 60°c. *in vacuo*, and acetylated by acetic anhydride vapour at 50° and 100°c. Acetylation velocity and tensile strength of the acetylated rayon are small when only sulphamic acid is used as catalyser, but high with a mixture of sulphamic acid and urea.

III—Nitration with Nitric Acid–Acetic Anhydride Mixture

Ibid., 159–161 (xvii–xviii)

Velocity of nitration at 10°c. was low either without or with sulphamic acid as catalyser; in the latter case, however, nitration was completed in 4 hr. at 30°c., when the nitrated substance dissolved completely in acetone, but only took 1 hr. at 40°c. The degree of heat resistance of the samples reacted at 10° and 30°c. with sulphamic acid was lower and that of the samples reacted at 40°c. was higher than the samples nitrated without sulphamic acid. H.H.H.

Reactions of Cellulose with Glyoxal
F. S. H. Head

J. Textile Inst., **49**, T 345–T 356 (July 1958)

It is known that when viscose rayon fabrics are impregnated with glyoxal containing a small amount of an acid catalyst, dried and heated for a short time, they acquire an increased resistance to shrinkage and creasing. The effect has been ascribed to cross-linkages between the cellulose chains. In the present work glyoxal is shown to react with purified cotton cellulose to form semiacetals, monoacetals, and diacetals. The analytical methods are described. P.T.S.

PATENTS

Size for Paper
Sinclair Refining Co. *USP* 2,837,439

Aqueous emulsions of 0·4 part of partially (91·5–95%) saponified rosin and 1 part of aromatic lubricating oil has good stability and can be produced as strong concentrates. They are excellent paper sizes which reduce the permeability of paper to liquids and effectively bind the fibres. C.O.C.

Brightness of High Density Wood Pulp
Food Machinery and Chemical Corpn. *USP* 2,822,236

The brightness of chemical and semi-chemical pulps e.g. Kraft, soda or sulphite pulps, bleached to 50–85 GE Units with chlorine and/or hydrogen peroxide, is maintained for 4–6 weeks' storage, by dewatering the pulp to a density of 35%, incorporating 0·02–0·25% hydrogen peroxide (by wt. of dry pulp) and adjusting the pH of the pulp to 6–10, after which it is dried to 75–95% density. R.A.

Mineral-coated Paper and Board
Rohm & Haas Co. *BP* 802,967

Viscosity difficulties encountered with acrylate/acrylic acid copolymer binders are overcome by using an entirely neutral comonomer for obtaining adhesion in the copolymer. For each 100 pts. by wt. of pigment (clay) the coating contains 8–25 pts. of a copolymer of an alkyl acrylate with an amide of methacrylic, acrylic, itaconic, aconitic, maleic or fumaric acid (2·5–7% by wt. in copolymer). Other binders may be included, as well as hardening comonomers, e.g. alkyl methacrylates, styrene, acrylonitrile, methacrylonitrile, vinyl and vinylidene chloride etc. without raising the T_1 value above 20°c. R.A.

Photographic Paper
Kodak *BP* 802,919

Migration of silver halide into the styrene-butadiene resin-pigment layer is prevented by the application of a barrier coating containing gelatine and/or styrene-butadiene resin over the pigment layer. This barrier coating is dried against a polished surface before the photographic silver halide emulsion is applied. R.A.

Surface-finishing of Paper and Cardboard
A. Schneider *BP* 803,670

Coatings which can be applied with a glue press to give uniform and smooth surfaces on which inks will not run or spread, are prepared by mixing a cellulose derivative with a soln. of an aluminium salt and bubbling ammonia through until slightly alkaline. Suggested cellulose derivatives are: methyl cellulose and the alkali salts of carboxymethyl cellulose or cellulose ether sulphonic acid. Aluminium may be replaced by zinc, copper or tin. Calcium and magnesium do not give such satisfactory results. Catalysts, e.g. aluminium or zinc dust, accelerate the ion exchange reaction, allowing lower drying temperatures to be used. Inclusion of finely dispersed paraffin imparts water-repellent properties. Colour pigments may be added. R.A.

Silicone-coated Paper
Midland Silicones *BP* 804,198

One side of the paper is treated with a solution or aqueous emulsion of a mixture of 0·1–5·0% by weight of methylhydrogen siloxane, 99·9–95·0% of a hydroxylated siloxane of viscosity < 100 cps. at 25°c., formula $CH_3SiO_{\frac{4-x}{2}}$ (x = 1·9–2·0) and containing at least two silicon-bonded hydroxyl groups, and a catalyst. It is then dried and cured. The treated paper can be rolled without any of the silicone transferring itself to the untreated side of the paper. C.O.C.

Grease- and Moisture-proof Paper
W. Colley *BP* 802,820

A dispersion of a natural or synthetic rubber (3–30%) is added to sulphite or sulphate pulp, containing stabilisers and/or thickeners, during beating. The mix is acidified to pH 5·5 with aluminium sulphate and beating continued. Final coagulation is brought about by acidification to pH 4·5 with more aluminium sulphate. Other substances may by added to the mix, e.g. granulated cork for flexibility, glue-glycerine compound for softness and strength, and carbon black as vulcanisation activator. R.A.

Stencil Paper for Auxiliary Photographic Negatives
Caribonum *BP* 802,811

A light-permeable paper is coated on the top side with a suspension in a wax/oil vehicle or chrome yellow (C.I. Pigment Yellow 34), Victoria Blue B (C.I. Basic Blue 26) in oleic acid, and Titanium White (C.I. Pigment White 6). The underside of the paper carries a light-impervious transfer composition comprising Carbon Black (C.I. Pigment Black 7), oleic acid and Methyl Violet 10B (C.I. Basic Violet 3). On writing upon the coated top-surface, the coating is completely removed or displaced, while the carbon coating on the underside is transferred to an underlying copy sheet, allowing light to pass through on subsequent exposure, e.g. marking of X-ray films. R.A.

Cast-surfaced Coated Paper
S. D. Warren Co. *USP* 2,819,184

Sticking of the set coated surface to the finishing surface is prevented by application of an aqueous ammonium resinate release agent to the coating surface immediately before it contacts the casting roll. R.A.

Reducing Frictional Drag of Coated Paper
Fibreboard Paper Products Corpn. *USP* 2,819,986

Frictional surface resistance is reduced by application of a lubricating film of a drag reducing agent to the surface of waxed paper and board. A recommended composition comprises 79·5–99% (by wt.) of water, up to 0·5% of a surface active agent, e.g. polyethylene sorbitan monoleate (Tween 80), and 1–20% of an organic liquid, e.g. Carbowax 1500, polyethylene glycol 300, polyethylene glycol 600, glycerine, mineral oil, etc. R.A.

Washable Wallpaper and Lacquer for producing it
Eastman Kodak Co. *USP* 2,839,432

Cellulose acetate butyrate lacquer containing 60–75% cellulose acetate butyrate (butyryl content > 35%, acetyl content 5–18%) plasticising resin obtained by treating 1:2-propylene glycol with adipic acid (5–25%) and, if desired, 5–15% of a flatting agent, applied to wallpaper gives it a washable coating. C.O.C.

XII— LEATHER; FURS; OTHER PROTEIN MATERIALS

Heating of Painted Sheepskins in Pile

G. H. Green

J. Soc. Leather Trades Chem., **42**, 304–312 (Sept. 1958)

The heating in pile of sheepskins painted with lime–sulphide paint has been shown to be due to bacterial growth on the damp, dirty wool or hair; factors influencing the heating are discussed. Antiseptic treatments delay the onset of heating. Resulting damage is related to the alkalinity of the paint, the temp. reached in the pile, and to the type of leather produced from the pelt. J.W.D.

Novel Type of Metal-Protein Compound

K. H. Gustavson

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PATENTS

Tanning Agent

U.S. Secretary of Agriculture *USP* 2,829,943

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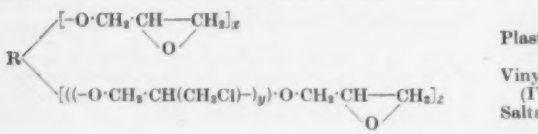

(R = glyceryl; x = 1 or 2; y = 1 or 2; z = 1 or 2; $x + z$ = 2 or 3) results in leather which is white throughout its thickness. When the leather is heated above its shrink temperature it shrinks somewhat but regains its original handle, shape and dimensions upon being cooled. It is readily re-wetted and completely resistant to detannage by acids, alkalis, and other agents. C.O.C.

Tanning with Acidic Solutions of Alkali Metal Zirconium Silicates

Rohm & Haas *USP* 2,826,477

Compounds in which the molar ratio $SiO_2 : ZrO_2$ is $\geqslant$ 1·5 : 1 and SiO_2 : alkali metal oxide is $\geqslant$ 3 : 1, e.g. Na_2ZrSiO_5 and $Na_4Zr_2Si_3O_{12}$, can be used in acid tanning liquors to produce leather having all the qualities of a Zr-tanned leather produced by water-soluble zirconium salts in absence of silicic acid. The leather has none of the disadvantages normally resulting when tanning is effected in presence of silicic acid. C.O.C.

Mildewproof Leather

U.S. Secretary of Commerce *USP* 2,838,426

Leather containing 0·3–0·6% by weight of the dry leather of bis(4-nitrophenyl)carbonate or bis(2-chloro-4-nitrophenyl)carbonate is mildewproof under tropical jungle conditions, the proof being resistant to severe weathering. They have the advantage over 4-nitrophenol in that they do not colour the leather and are non-toxic. C.O.C.

Coating of Leather

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Improved adhesion is obtained between leather and polymers applied to it in an aqueous vehicle if the polymer contains hydroxyl groups. This leather coated with an aqueous dispersion of 3% of a linear polymer of a monomer of formula CH_2:CH·A·R^1·OH (A = O or S; R^1 = straight or bonded alkylene of 2–10 C, $C_2H_4AC_2H_4$–, ·C_2H_4·N(R^2)·C_2H_4 or –$C_2H_4N(R^3)(R^4)(X)C_2H_4$– ($R^2$ = H, CH_3, C_2H_5 or C_2H_4OH; R^3 and R^4 = CH_3, C_2H_5 or C_2H_4OH; X = negative radical), e.g. β-hydroxyethyl vinyl sulphide or hydroxyethyldimethyl(vinyloxyethyl)ammonium hydroxide), has good resistance to scuffing and wet moulding.

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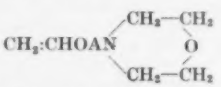

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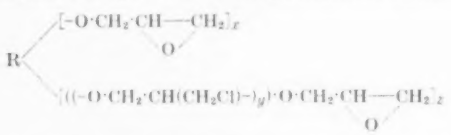

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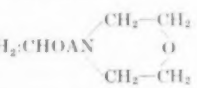

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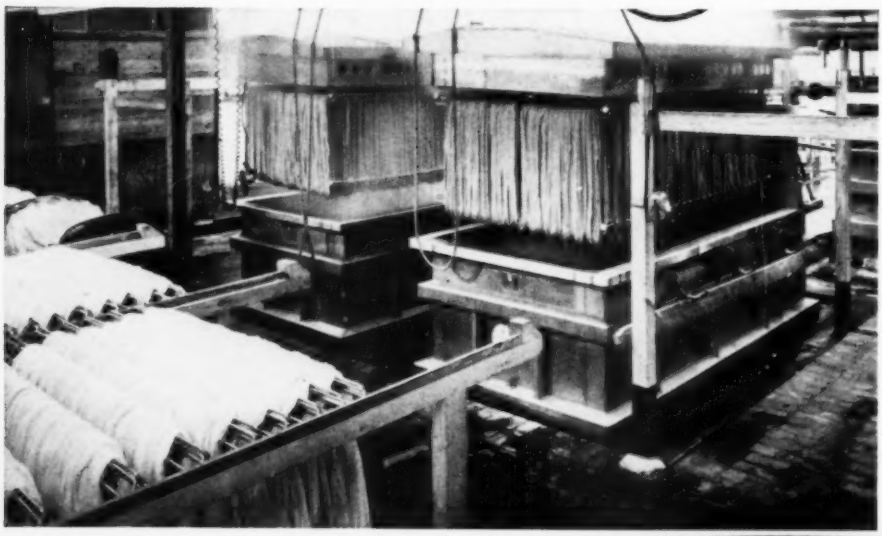
DOUBLE STICK HANK DYEING MACHINES

Suitable for dyeing hosiery, and hand knitting yarns, sewing threads, high bulk yarns, tapes, etc.

These machines, incorporating the Brown Longclose Double Stick System (patent applied for) are available as single units for dyeing from 10 lb. to 700 lb. and as coupled units to dye up to 1400 lb. to a single shade. When operating as coupled units an even shade is obtained and yarn from both units can be mixed indiscriminately.



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APPOINTMENTS

Advertisements relating to APPOINTMENTS VACANT, APPOINTMENTS WANTED, and MISCELLANEOUS ITEMS are invited for insertion on this page. Advertisements of Appointments Wanted are gratis to members, but must not exceed twenty-four words.

All inquiries relating to Advertisements should be addressed to THE GENERAL SECRETARY, THE SOCIETY of DYERS and COLOURISTS, DEAN HOUSE, 19 PICCADILLY, BRADFORD 1, YORKSHIRE.

Replies may be addressed BOX—, THE SOCIETY of DYERS and COLOURISTS, DEAN HOUSE, 19 PICCADILLY, BRADFORD 1, YORKSHIRE, where all communications relating to these Advertisements are treated in strict confidence.

APPOINTMENTS VACANT

THE INTERNATIONAL WOOL SECRETARIAT

AN EDITORIAL ASSISTANT is required by the International Wool Secretariat; the chief duty will be editing a quarterly scientific journal on wool but assistance will be required in the production of other publications. As these publications are designed to explain complex scientific matters to the Wool Industry applicants must be able to interpret research results accurately, interestingly, and lucidly. A Science Degree and some knowledge of French *and* German are essential; experience with textiles is desirable.

Commencing salary according to experience between £800–£1000 p.a.; a superannuation scheme is in operation.

Applications giving full particulars to Ref. TA, Dr. E. G. Carter, International Wool Secretariat, Dorland House, 18–20 Regent Street, London, S.W.1, marked "Confidential".

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NEW YORK

APPLICATIONS will be considered from well-qualified men, in age group 35–45 years, for a senior position devoted to the sales promotion of vat dyestuffs in U.S.A. Applicants must have university education and sufficient knowledge of the chemistry of vat dyes to deal intelligently with those concerned with that aspect of the business. However, the main objective is sales promotion and applicants must be well versed in all fields of application. Duties will include market surveys and analyses, organisation of sales programmes, and, in general, the development and supervision of a sales effort specific to vat dyes. Good personality and an aptitude for selling are essential as personal contacts are an important feature of the position which will command an excellent salary and provide outstanding opportunities for the successful candidate. Applications with full details and photograph attached should be sent to Box V161.

TEXTILE/COLOUR CHEMIST

COURTAULDS LIMITED require a TEXTILE or COLOUR CHEMIST (or Organic Chemist with an interest in dyestuffs) for its Droylsden Research Laboratory near Manchester. Good academic qualifications and at least two years industrial experience essential.

Candidates should write for a detailed form of application to the Director of Personnel, Courtaulds Limited, 16 St. Martins-le-Grand, London, E.C.1, quoting reference number D.92.

LONG EATON FABRIC COMPANY (Nottingham Dyers) LTD. invite applications for position of Dyer/Chemist about to be created in their works at Chilwell, Nottingham. Candidates must have good technical and practical background, suitable laboratory and dyehouse experience, and preferably knowledge of the dyeing and finishing of nylon knitted fabrics and of the mercerising, bleaching and finishing of cotton goods. Salary according to qualifications and experience. Apply, in confidence, with full personal details, to the Managing Director, Long Eaton Fabric Co. Ltd., By Pass Road, Chilwell, Nottingham.

YOUNG man wanted for dyehouse laboratory. Minimum qualification of A.R.I.C., to work as assistant on analytical and investigation of dyeing methods etc. Apply by letter only giving fullest particulars of education and career to Personnel Manager, N. Corah (St. Margaret) Ltd., Leicester.

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The Journals of the Society having been returned through the post it is desired to obtain information for these to be forwarded and any assistance in this respect will be appreciated

Cameron, M. C., *formerly of* 11 Thirlmere Gardens, Belfast, N. Ireland

Ciprut, J. V., *formerly of* Technical College, Dyeing Dept., Bradford, Yorkshire

Drzewicki, M., *formerly of* Flat 2, 11 Rectory Road, West Bridgford, Nottinghamshire

Gale, R. A., *formerly of* 32 Wordsworth Street, Hapton, near Burnley, Lancashire

Harvey, H. C., *formerly of* 77 Edinburgh Road, Congleton, Cheshire

Heaton, R., *formerly of* 142 Browning Road, Manor Park, London E.12

Hubler, B., *formerly of* Park Hotel, Oak Avenue, Manningham, Bradford 8

Jackson, J. B., *formerly of* 36 Arden Road, Crumpsall, Manchester 8

Jliadis, S., *formerly of* Nottingham and District Technical College, Shakespeare Street, Nottingham

Kothawala, Amin A., *formerly of* 36 Briarwood Drive, Wibsey, Bradford 6

Kubba, S., *formerly of* 10 Malone Road, Belfast, N. Ireland

Le Bek, I. A. G., *formerly of* 8 Lad-Hill Lane, Greenfield, near Oldham, Lancashire

Maschas, L., *formerly of* 43 St. John's Road, Huddersfield

Midgley, F. B., *formerly of* "Clova", 57 Jeremy Lane, Heckmondwike, Yorkshire

Oxley, R., *formerly of* 27 Hayling Road, Sale, Manchester

Rahman, S. M. K., *formerly of* Lock View Hall, 1025 Gt. Western Road, Glasgow

Richardson, D., *formerly of* 139 Laund Road, Salendine Nook, Huddersfield

Slater, W. K., *formerly of* 85 Hope Road, Sale, Cheshire

Smith, L., *formerly of* 80 Fair View Road, Bacup, Lancashire

Tsien, P. C., *formerly of* 1332 Tenan Road, Shanghai, China

Wahba, F. S., *formerly* c/o Beida Dyers S.A.E., P.O. Bag., Alexandria, Egypt

Wailes, N. T., *formerly of* "Hamewith", 4 Kingsway Terrace, Dundee, Scotland

Walker, T. H., *formerly of* J. L. Stifel & Sons Inc., 339 Main Street, Wheeling, W. Va., U.S.A.

Zwicky, A. M., *formerly of* 23 West Leight Street, Crumpsall, Manchester 9

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Suitable for dyeing hosiery, and hand knitting yarns, sewing threads, high bulk yarns, tapes, etc.

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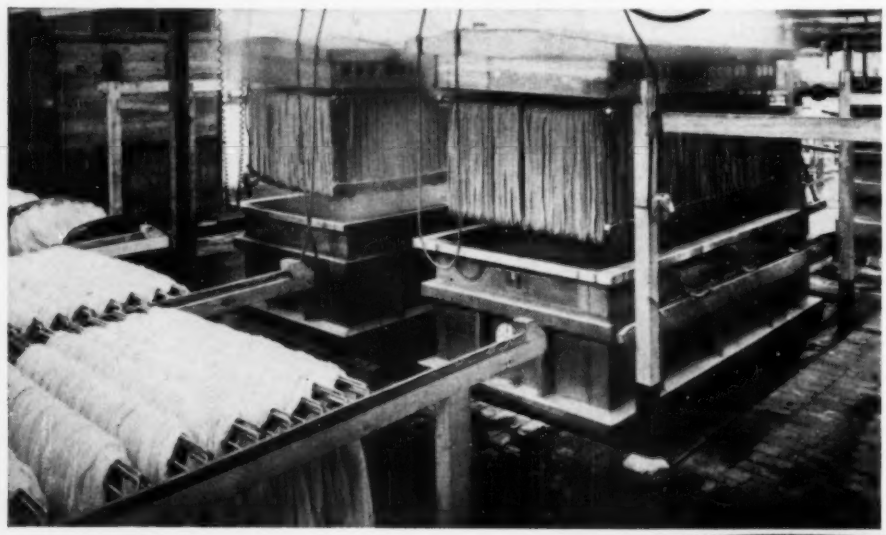

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Advertisements relating to APPOINTMENTS VACANT, APPOINTMENTS WANTED, and MISCELLANEOUS ITEMS are invited for insertion on this page. Advertisements of Appointments Wanted are gratis to members, but must not exceed twenty-four words.

All inquiries relating to Advertisements should be addressed to THE GENERAL SECRETARY, THE SOCIETY of DYERS and COLOURISTS, DEAN HOUSE, 19 PICCADILLY, BRADFORD 1, YORKSHIRE.

Replies may be addressed BOX—, THE SOCIETY of DYERS and COLOURISTS, DEAN HOUSE, 19 PICCADILLY, BRADFORD 1, YORKSHIRE, where all communications relating to these Advertisements are treated in strict confidence.

APPOINTMENTS VACANT

THE INTERNATIONAL WOOL SECRETARIAT

AN EDITORIAL ASSISTANT is required by the International Wool Secretariat; the chief duty will be editing a quarterly scientific journal on wool but assistance will be required in the production of other publications. As these publications are designed to explain complex scientific matters to the Wool Industry applicants must be able to interpret research results accurately, interestingly, and lucidly. A Science Degree and some knowledge of French *and* German are essential; experience with textiles is desirable.

Commencing salary according to experience between £800–£1000 p.a.; a superannuation scheme is in operation.

Applications giving full particulars to Ref. TA, Dr. E. G. Carter, International Wool Secretariat, Dorland House, 18–20 Regent Street, London, S.W.1, marked "Confidential".

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APPLICATIONS will be considered from well-qualified men, in age group 35–45 years, for a senior position devoted to the sales promotion of vat dyestuffs in U.S.A. Applicants must have university education and sufficient knowledge of the chemistry of vat dyes to deal intelligently with those concerned with that aspect of the business. However, the main objective is sales promotion and applicants must be well versed in all fields of application. Duties will include market surveys and analyses, organisation of sales programmes, and, in general, the development and supervision of a sales effort specific to vat dyes. Good personality and an aptitude for selling are essential as personal contacts are an important feature of the position which will command an excellent salary and provide outstanding opportunities for the successful candidate. Applications with full details and photograph attached should be sent to Box V161.

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LONG EATON FABRIC COMPANY (Nottingham Dyers) LTD. invite applications for position of Dyer/Chemist about to be created in their works at Chilwell, Nottingham. Candidates must have good technical and practical background, suitable laboratory and dyehouse experience, and preferably knowledge of the dyeing and finishing of nylon knitted fabrics and of the mercerising, bleaching and finishing of cotton goods. Salary according to qualifications and experience. Apply, in confidence, with full personal details, to the Managing Director, Long Eaton Fabric Co. Ltd., By Pass Road, Chilwell, Nottingham.

YOUNG man wanted for dyehouse laboratory. Minimum qualification of A.R.I.C., to work as assistant on analytical and investigation of dyeing methods etc. Apply by letter only giving fullest particulars of education and career to Personnel Manager, N. Corah (St. Margaret) Ltd., Leicester.

ADDRESSES WANTED FOR RE-DIRECTION OF JOURNALS

The Journals of the Society having been returned through the post it is desired to obtain information for these to be forwarded and any assistance in this respect will be appreciated

Cameron, M. C., *formerly of* **11 Thirlmere Gardens, Belfast, N. Ireland**

Ciprut, J. V., *formerly of* **Technical College, Dyeing Dept., Bradford, Yorkshire**

Drzewicki, M., *formerly of* **Flat 2, 11 Rectory Road, West Bridgford, Nottinghamshire**

Gale, R. A., *formerly of* **32 Wordsworth Street, Hapton, near Burnley, Lancashire**

Harvey, H. C., *formerly of* **77 Edinburgh Road, Congleton, Cheshire**

Heaton, R., *formerly of* **142 Browning Road, Manor Park, London E.12**

Hubler, B., *formerly of* **Park Hotel, Oak Avenue, Manningham, Bradford 8**

Jackson, J. B., *formerly of* **36 Arden Road, Crumpsall, Manchester 8**

Jliadis, S., *formerly of* **Nottingham and District Technical College, Shakespeare Street, Nottingham**

Kothawala, Amin A., *formerly of* **36 Briarwood Drive, Wibsey, Bradford 6**

Kubba, S., *formerly of* **10 Malone Road, Belfast, N. Ireland**

Le Bek, I. A. G., *formerly of* **8 Lad-Hill Lane, Greenfield, near Oldham, Lancashire**

Masohas, L., *formerly of* **43 St. John's Road, Huddersfield**

Midgley, F. B., *formerly of* **"Clova", 57 Jeremy Lane, Heckmondwike, Yorkshire**

Oxley, R., *formerly of* **27 Hayling Road, Sale, Manchester**

Rahman, S. M. K., *formerly of* **Lock View Hall, 1025 Gt. Western Road, Glasgow**

Richardson, D., *formerly of* **139 Laund Road, Salendine Nook, Huddersfield**

Slater, W. K., *formerly of* **85 Hope Road, Sale, Cheshire**

Smith, L., *formerly of* **80 Fair View Road, Bacup, Lancashire**

Tsien, P. C., *formerly of* **1332 Tenan Road, Shanghai, China**

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Bailie, W. J. D., 4 Westland Avenue, Dundrum Road, Newcastle, Co. Down

Barton, A., 12 Floral Gardens, Whitewell, Belfast

Birch, H., 20 Daisy Bank, Bacup, Lancashire

Buxbaum, E. C., P.O. Box 525, Du Pont Co., Wilmington, Delaware, U.S.A.

Marsland, D., 37 Ripon Terrace, Akroydon, Halifax, Yorkshire

Zajdman, I. U., 12 Spring Road, Leeds 6

MEMBERS' CHANGES OF ADDRESS

Allen, R. J. C., *formerly of* 27 Shanklin Avenue, Leicester, *to* 8 Glibe Crescent, Tillicoultry, Clackmannanshire, Scotland

Boardman, G. L., *formerly of* 2 Linton Avenue, Bury, Lancashire, *to* 11a Bedford Avenue, Walkden, Manchester, Lancashire

Bolton, F., *formerly of* Lanks Chemicals Ltd., Salters Lane, Eccles, Manchester, *to* Moor Lea, Moorland Crescent, Guiseley, near Leeds

Broadbent, H. C., *formerly of* 75 Wilson Road, Wyke, Bradford, *to* 60 Dunford Road, Holmfirth, near Huddersfield

Chitnis, M. P., *formerly of* Institute of Technology, Bradford, *to* c/o Farbenfabriken Bayer, A.G., Farben Export (India), Leverkusen, Germany

Corbett, E., *formerly of* 25 Recreation Road, Coventry, Warwickshire, *to* 77 Heath Lane, Brinklow, Rugby, Warwickshire

Gibbons, T F., *formerly of* Maesbach, Cardiff Road, Creigiau, near Cardiff, *to* Aero Zipp Fastners Ltd., Treforest Industrial Estate, near Pontypridd

Gilbert, A. C., *formerly of* 20 Downs View Road, Swindon, Wiltshire, *to* 40 Heol Ffynnon Wen, Pantmanr Estate, Cardiff

Harmsworth, G. L., *formerly of* Beechfield, Windy Harbour Lane, Bromley Cross, Bolton, Lancashire, *to* Rhianfa, Curley Hill, Ilkley, Yorkshire

Laskowski, L. S., *formerly of* 8 Regent Street, New Basford, Nottingham, *to* 3 Beaumaris Drive, Llanyravon, Cwmbran, Monmouthshire

O'Hare, B. J., *formerly of* 72 St. John's Road, Manchester 16, *to* 1 Marsden Road, Romiley, Cheshire

Phillips, I., *formerly of* 21 Windsor Avenue, Newton Mearns, Glasgow, *to* 24 Patch Croft Road, Peel Hall, Manchester 22

Schwarz, E. R., *formerly of* Kelsall & Kemp (Tasmania) Ltd., Launceston, Tasmania, *to* Holeproof Mills Ltd., G.P.O. Box 2215, Auckland, New Zealand

Shenton, A., *formerly of* Loughborough Dyeworks, Whitegate Mill, Nottingham Road, Loughborough, *to* 28 Kings Avenue, Loughborough, Leicestershire

Staynes, K., *formerly of* 31 King Street, Mosgiel, Otago, N.Z., *to* 7 Inglis Street, Mosgiel, Otago, N.Z.

Walton, A., *formerly of* 8 Knights Avenue, Tettenhall, Wolverhampton, Staffordshire, *to* Croftside, 15 Drury Avenue, Spondon, near Derby

Young, J. A. *formerly of* Greystones, Busby, Lanarkshire, *to* Craggie, By Dalbeattie, Kirkcudbrightshire

FORTHCOMING MEETINGS OF THE SOCIETY — *continued from page* x

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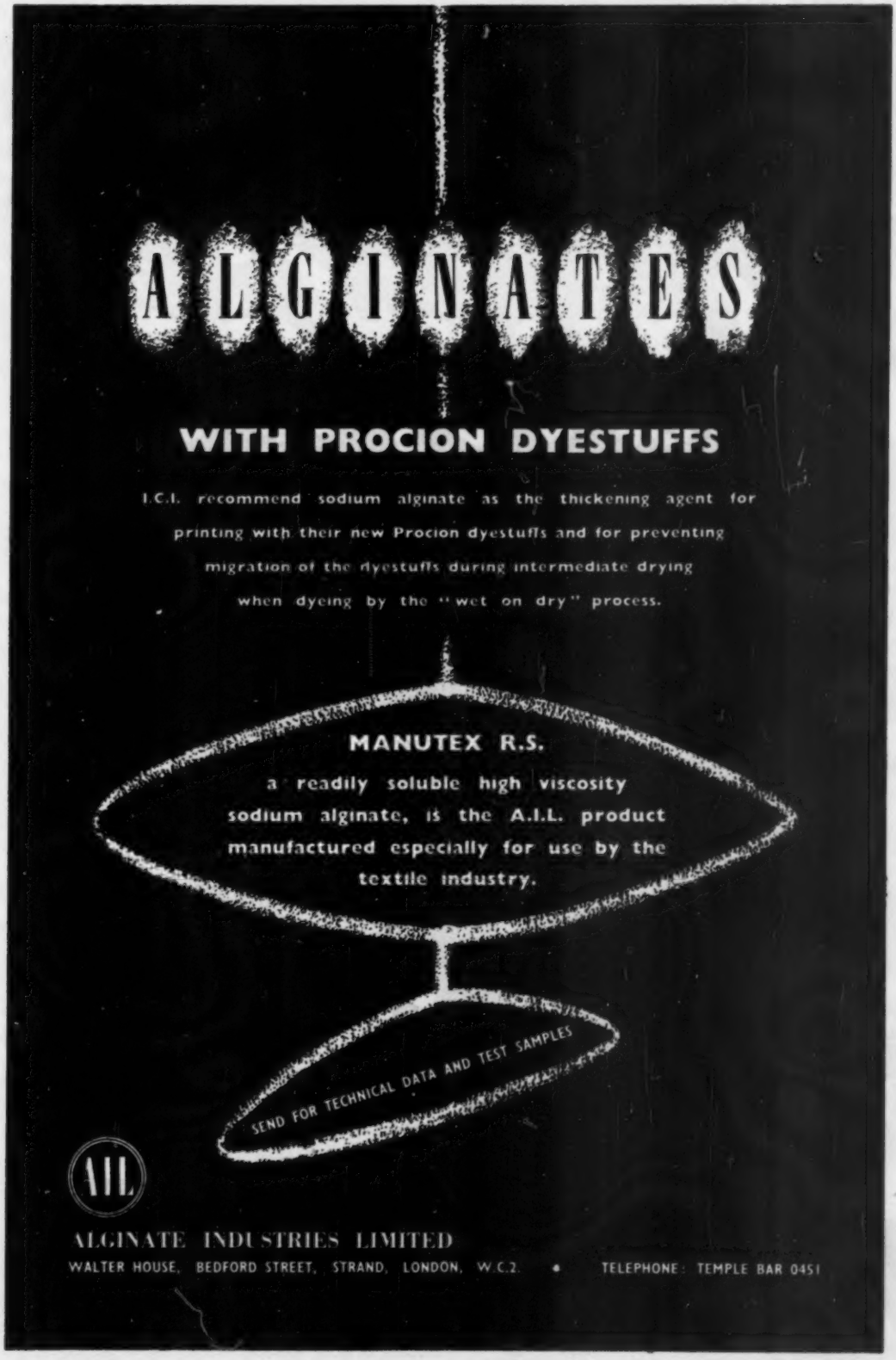
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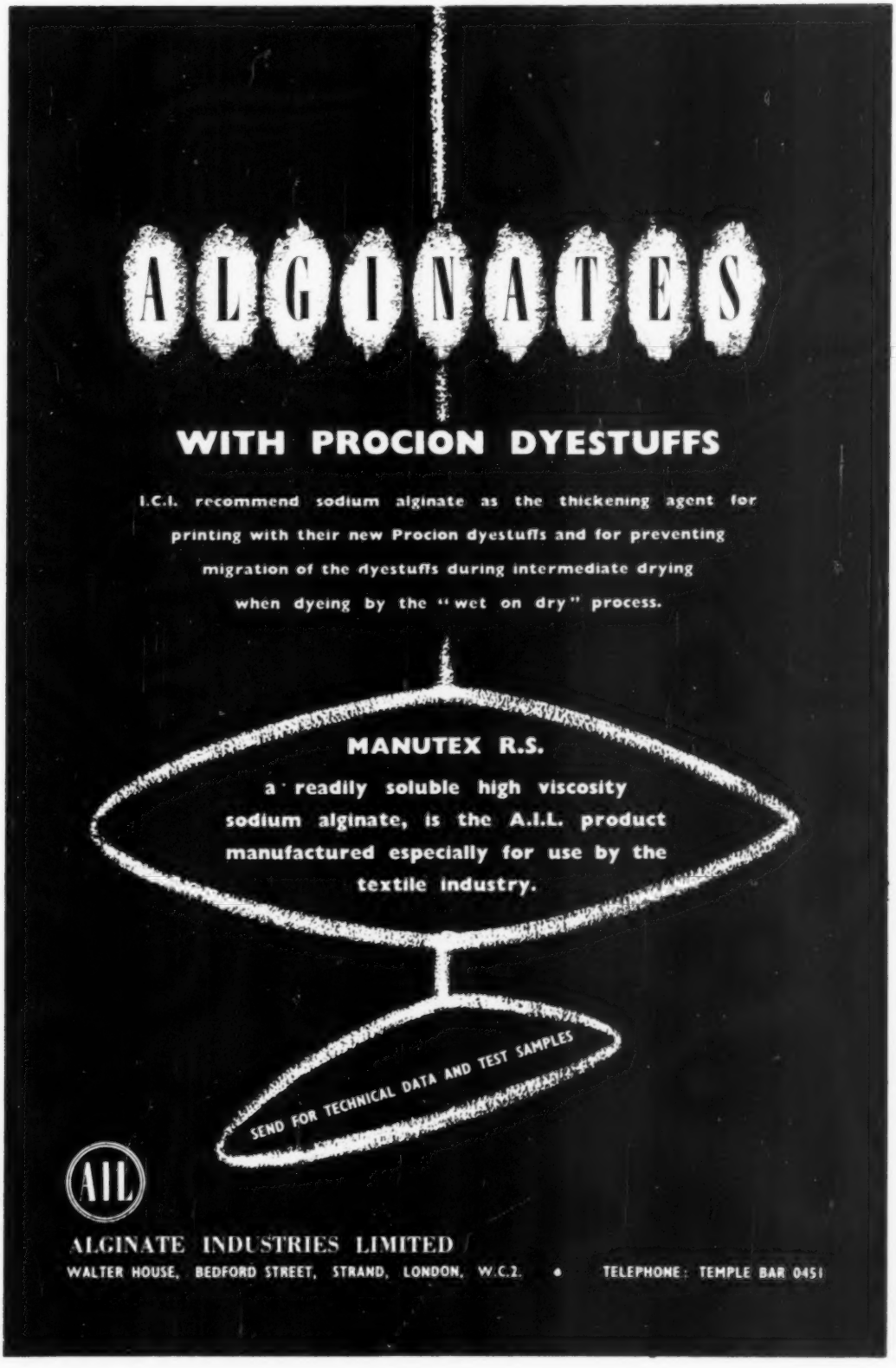
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ADDITIONS AND AMENDMENTS TO COLOUR INDEX

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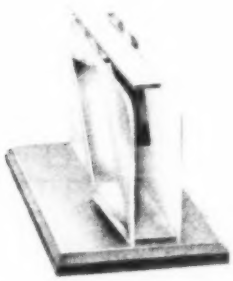

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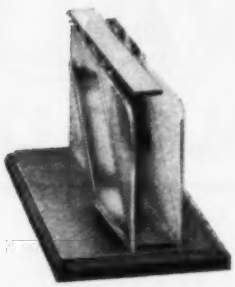

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The Society of Dyers and Colourists

THE ANNUAL GENERAL MEETING AND DINNER

will be held at

THE GRAND HOTEL LEICESTER

on

FRIDAY 10 APRIL 1959

Advance Announcement

THE SOCIETY OF DYERS AND COLOURISTS

THE FIFTEENTH MERCER LECTURE

will be given at the **CHARING CROSS HOTEL**
Strand London WC2

on **Friday 1 May 1959**

at **7.30 pm**

by **I. S. MOLL Esq B.Sc**

Title of the lecture

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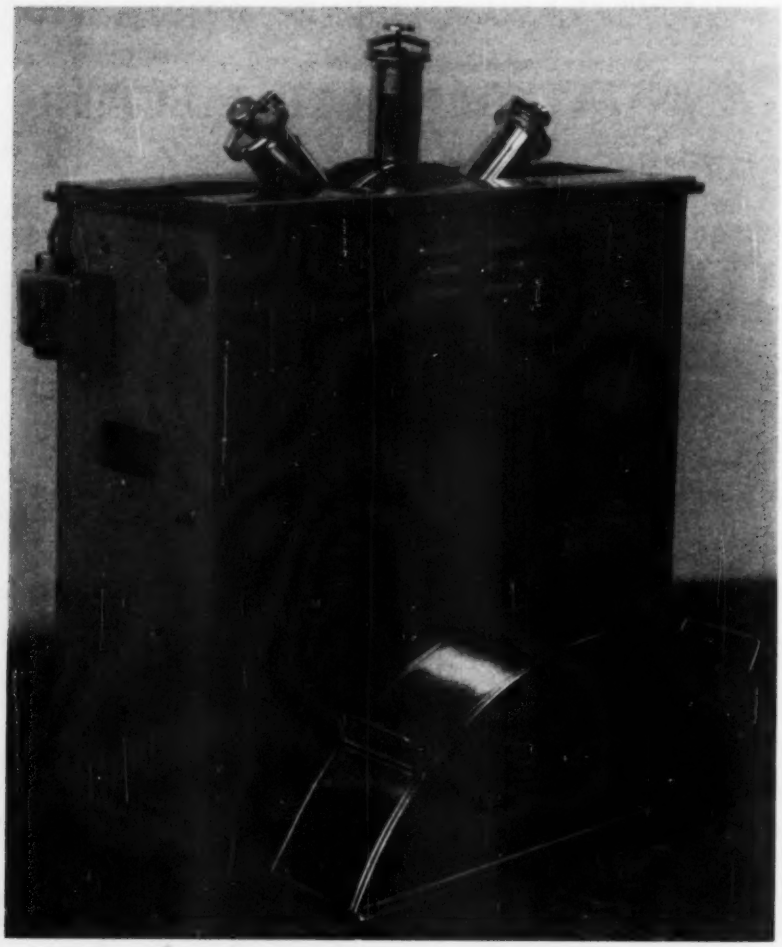
Members of other societies and the public will be welcome at the lecture

An appeal is made for full support of this important occasion by Members and their friends. All interested are invited to attend

Special Announcement

THE NEW WASH WHEEL



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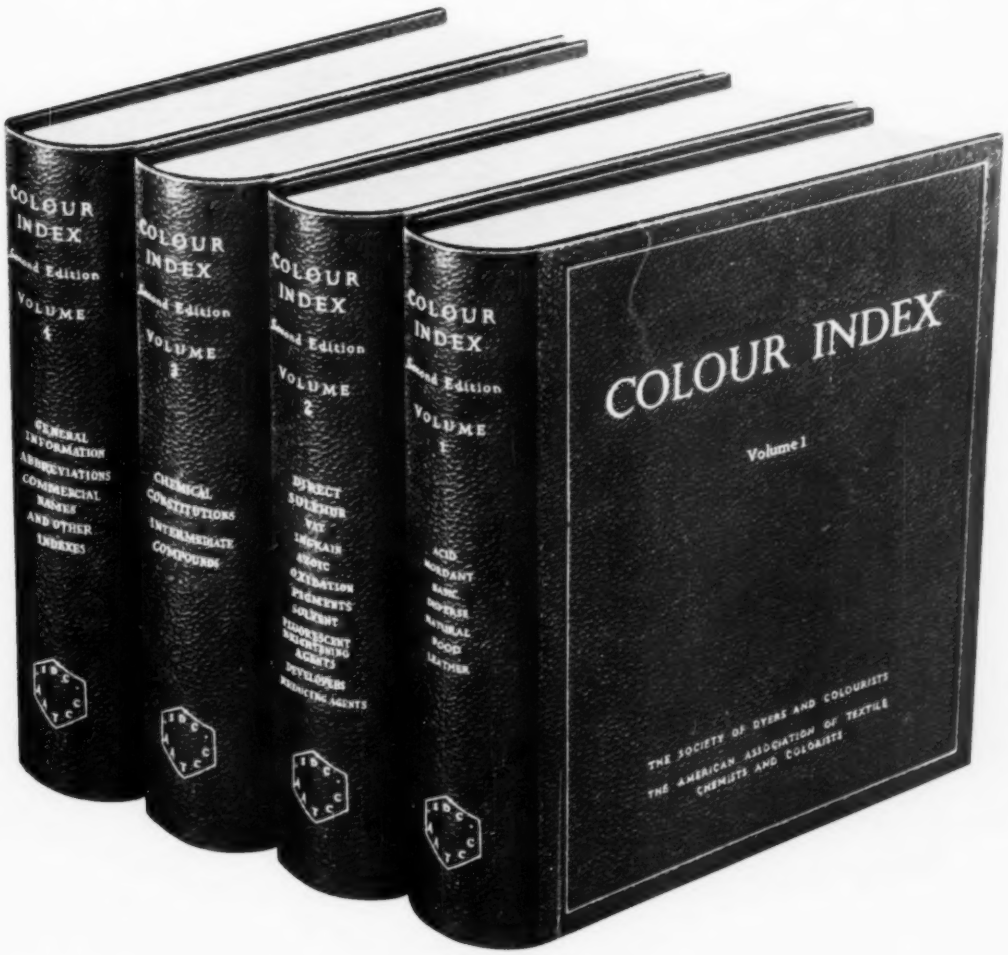
and

THE AMERICAN ASSOCIATION OF TEXTILE CHEMISTS AND COLORISTS



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3-BOWL HIGH EXPRESSION MANGLE

1—Special small capacity troughs

2—Automatic dye level control

3—Totally enclosed drive

4—Built-in instrument panel

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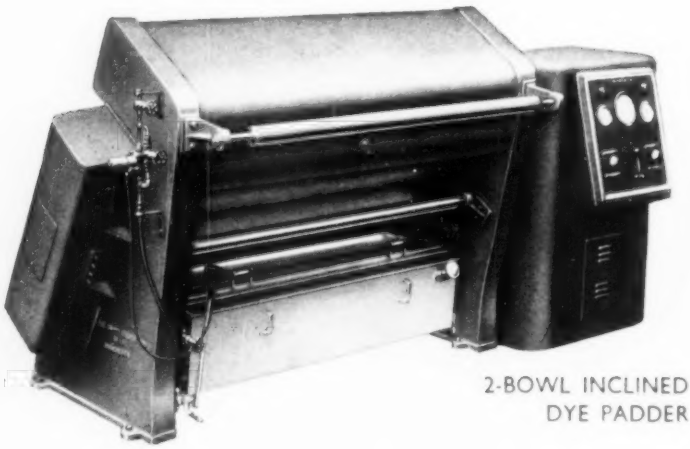

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